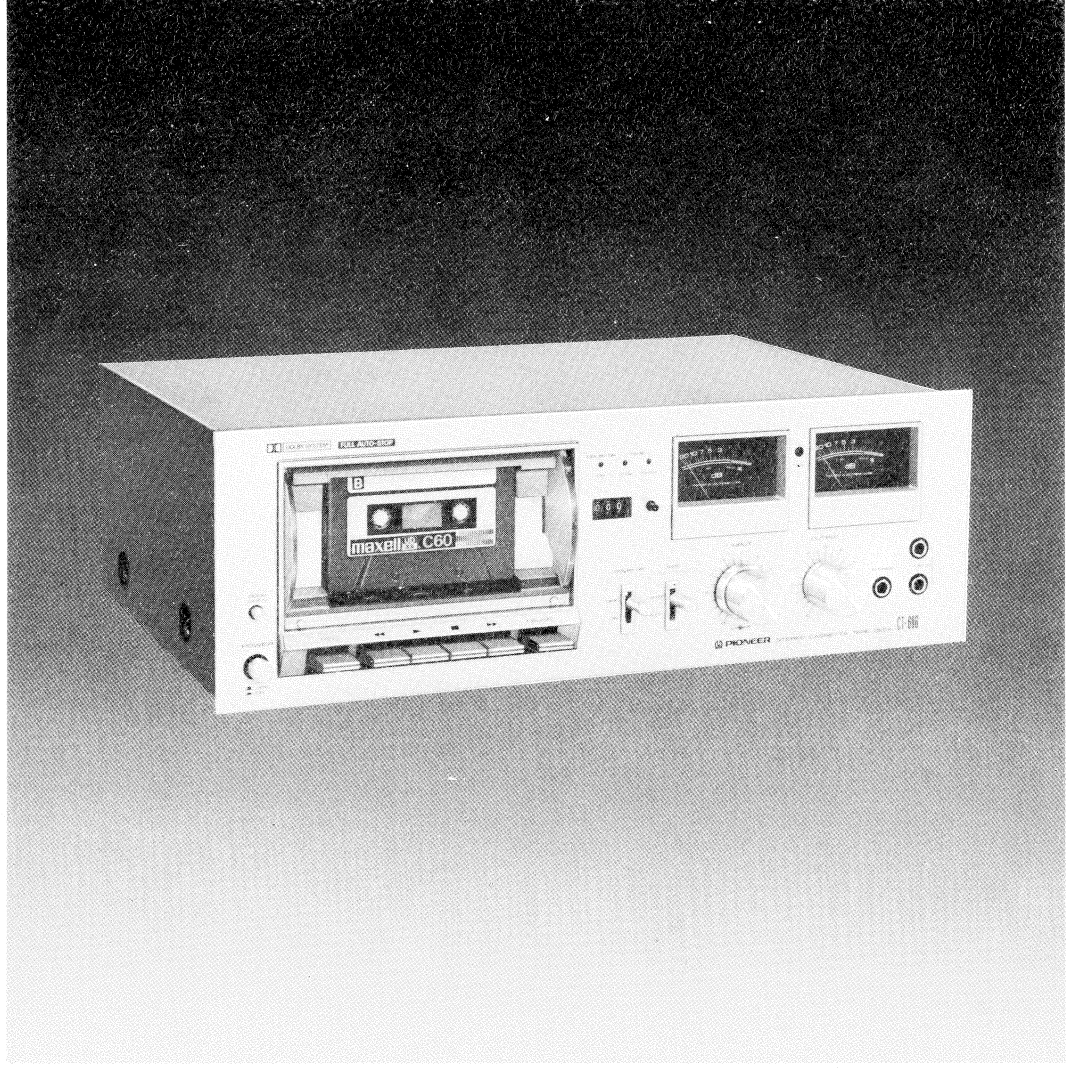

Service Manual

CASSETTE TAPE DECK

CT-606

PIONEER®

MODEL CT-606 COMES IN THREE VERSIONS DISTINGUISHED AS FOLLOWS:

Type	Voltage	Remarks
HG	220V and 240V (Switchable)	Europe or Oceania model
D	120V, 220V and 240V (Switchable)	General export model
D/G	120V, 220V and 240V (Switchable)	U.S. Military model

- **This service manual is applicable to the CT-606/HG. For servicing of the other types please refer to the additional service manuals.**

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1. SPECIFICATIONS

Systems . . . . . Compact cassette, 2-channel stereo
Motor . . . . . Electronically-controlled DC motor (built-in generator) x 1
Heads. . . . . "Permalloy Solid" recording/playback head x 1
Ferrite erasing head x 1
Fast Winding Time . . . . . Approximately 85seconds (C-60 tape)
Wow and Flutter . . . . . No more than 0.06% (WRMS)
No more than ±0.18% (DIN)
Frequency Response . . . . . Standard, LH tapes: 30 to 14,000Hz (40 to 13,000Hz ±3dB), (40 to 13,000Hz DIN)
Ferrichrome tape: 30 to 17,000Hz (40 to 15,000Hz ±3dB)
Chromium dioxide tape: 30 to 17,000Hz (40 to 15,000Hz ±3dB), (40 to 14,000Hz DIN)
Signal-to-Noise Ratio. . . . . Dolby NR OFF: More than 54dB
Dolby NR ON: More than 64dB (over 5kHz, standard, LH tapes)
(When chromium dioxide tape is used, signal-to-noise ratio is further improved by 4.5dB over 5kHz)
More than 58dB (DIN)
Harmonic Distortion . . . . . No more than 1.3% (0dB)
Inputs (Sensitivity/Maximum allowable input/Impedance)
MIC (L, R); 0.2mmV/45mV/10 kilohms, 6mm diam. jacks(Reference MIC impedance; 250 ohms to 10 kilohms)
LINE (2-channel stereo); 50mV/25V/100 kilohms
REC/PLAY x 1; Input & output, 9mV/2V/2.2 kilohms 5p jack (DIN standard)
Outputs (Reference level/Maximum level/Load impedance)
LINE (2-channel stereo); 450mV/700mV/50 kilohms
REC/PLAY x 1; 450mV/700mV/50 kilohms 5p jack (DIN standard)
Headphones x 1; 65mV/100mV/8 ohms, 6mm diam. jack
Semiconductors
Amplifier Section . . . . . Transistors x 50, Diodes x 35, FETs x 2
Motor control section . . . Transistors x 3, Diode x 1
Subfunctions
- Dolby system (ON-OFF) with indicator lamp
- Tape Selector (STD/FeCr/CrO_2)
  Automatic tape selector for CrO_2 tape
- Cassette compartment illumination

Power Requirements . . . . . AC 120V, 220V, 240V (switchable) 50/60Hz (D, D/G model) or AC 220V, 240V (switchable) 50/60Hz (HG model)
Power Consumption . . . . . 15 watts
Dimensions . . . . . 420(W) x 151(H) x 323.5(D) mm Max.
16-9/16 x 5-15/16 x 12-3/4 in
Weight 7.5kg (16lb 8oz)
Furnished parts . . . . . Stereo connecting cord with pin plugs x 2
Head cleaning kit x 1
Fuse (D, D/G model only) x 1
(120V; 1A or 220, 240V 500mA)
Operating instruction x 1

NOTE:
Specifications and the design subject to possible modification without notice due to improvements.

NOTES:

1. Reference Tapes : Standard & LH: DIN 45513/BLATT6 or equiv.
   : CrO_2: DIN 45513/BLATT7 (CrO_2) or equiv.
2. Reference Recording Level: Meter 0dB indicating level (160 nwb/m magnetic level = Philips cassette reference level)
3. Reference Signal: 333Hz
4. Wow & Flutter: • JIS [3kHz, with acoustic compensation (weighted), rms value] • DIN [3150Hz, with acoustic compensation (weighted) PEAK value]; DIN 45507
5. Frequency Response: • Measured at −20dB level, DOLBY NR OFF, level deviation is ±6dB without indication • DIN is DIN 45500
6. Signal-to-Noise Ratio: • Measured at +4dB level (250nwb/m magnetic level = DIN 45513 specified reference level), IEC A curve with acoustic compensation (weighted) • DIN is DIN 45500
7. Sensitivity: Input level (mV) required for reference recording level with input (REC) controls set to maximum.
8. Maximum Allowable Input: While decreasing settings of input (REC) level controls and increasing level at input jacks, this is the maximum input level (mV) at the point where recording amplifier output waveform becomes clipped.
9. Reference Output Level: Playback output level when meter indicates 0dB.
10. Maximum Output Level: Playback output level with respect to reference recording level when output (PLAY) level controls are set to maximum.

2. FRONT PANEL FACILITIES

POWER SWITCH

The power comes on when the POWER switch is depressed. The level meters and the remaining tape display light will then light up. To turn off the power, release the switch by depressing it again.

CASSETTE DOOR OPEN BUTTON

Depress this button to open the cassette door. Close the cassette door by gently sliding it downward by hand.

CASSETTE DOOR

Always keep this door closed to prevent dirt and dust from adhering to the head section and rotating parts.

DOLBY NR INDICATOR

This light comes on when the DOLBY NR switch is set to ON to indicate that the cassette deck is now set up for Dolby recording or Dolby playback.

CrO_2 INDICATOR

This light comes on when a chrome tape is being used. It will come on when a cassette is not loaded but this does not indicate a failure.

Fe-Cr INDICATOR

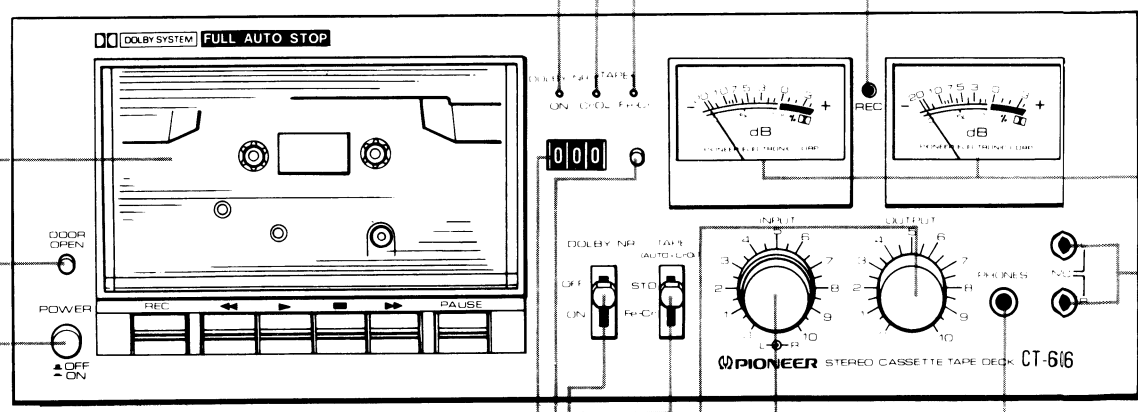
This light comes on when the TAPE switch is set to Fe-Cr.

LEVEL METERS

These indicate the input level during recording and the output level during playback.

REC INDICATOR

This light comes on when the play and REC levers are depressed together to indicate that the cassette deck is now set to the recording mode.



TAPE COUNTER

This indicates the position of the tape run.

COUNTER RESET BUTTON

Depress this button to reset the tape counter display to '000'.

DOLBY NR SWITCH

Set this switch to ON for recording with the built-in Dolby noise reduction system and for the playback of tapes which have been Dolby-recorded.

TAPE SWITCH

Select this switch according to the tape to be used.
STD: For ordinary tapes and low-noise/high-output tapes.
Fe-Cr.: For ferrichrome tapes.

OUTPUT LEVEL CONTROL

Use these controls to adjust the output signal. Turning them to the right increases the level. They cannot be used to adjust the level of the left and right channels independently.

INPUT LEVEL CONTROLS

Use them to adjust the input signal from the MIC jacks and the rear panel INPUT jacks.
Turning the control to the right increases the level. The controls are coupled to the left and right channels although you can also use them to adjust the right channel (rear) and the left channel (front) independently.

PHONES JACK

This is the output jack for stereo headphones. Use it when you want to monitor the quality of a recording or if you want to listen to a tape privately.

NOTES:
- *Use low-impedance headphones. If you use a high-impedance model, you will not be able to obtain sufficient volume.*
- *Do not connect a microphone to this jack as the microphone may be damaged.*

MIC JACKS

These are the input jacks for microphone recording. Plug the left channel microphone into L and the right channel microphone into R.

NOTE:
Disconnect your microphones from the MIC jack when you are not using them, otherwise you will not be able to record to LINE and DIN input terminals.

OPERATING LEVERS

REC LEVER

To record, depress this lever and the play lever together.
This lever will not work when a cassette is not loaded or when the erasure prevention tabs of a loaded cassette have been broken off.

REWIND LEVER (◀◀)

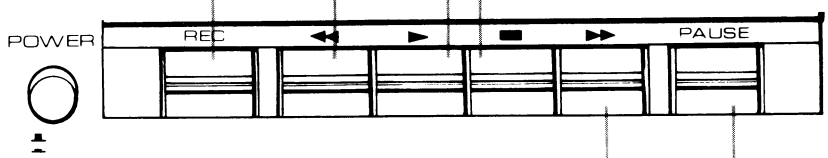
Depress this lever to rewind the tape (the tape will travel from right to left at high speed).

PLAY LEVER (▶)

Depress this lever when playing back a tape. Depress it together with the REC lever for recording (the tape will travel from left to right).

STOP LEVER (■)

When this lever is depressed during tape play, the operating levers in use will be released and the tape will stop.



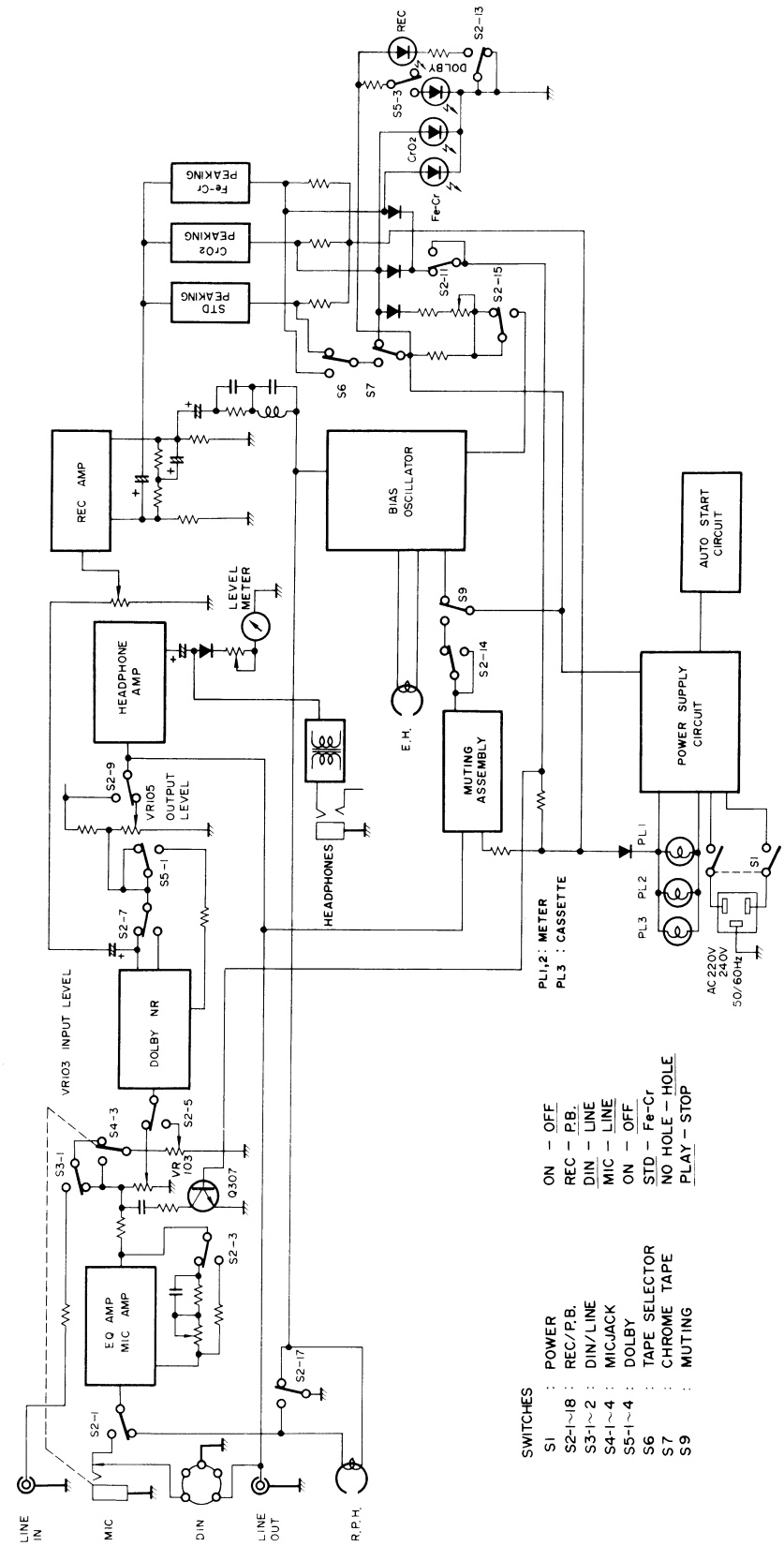
FAST FORWARD LEVER (▶▶)

Depress this lever to send the tape forward at top speed (the tape will travel from left to right).

PAUSE LEVER

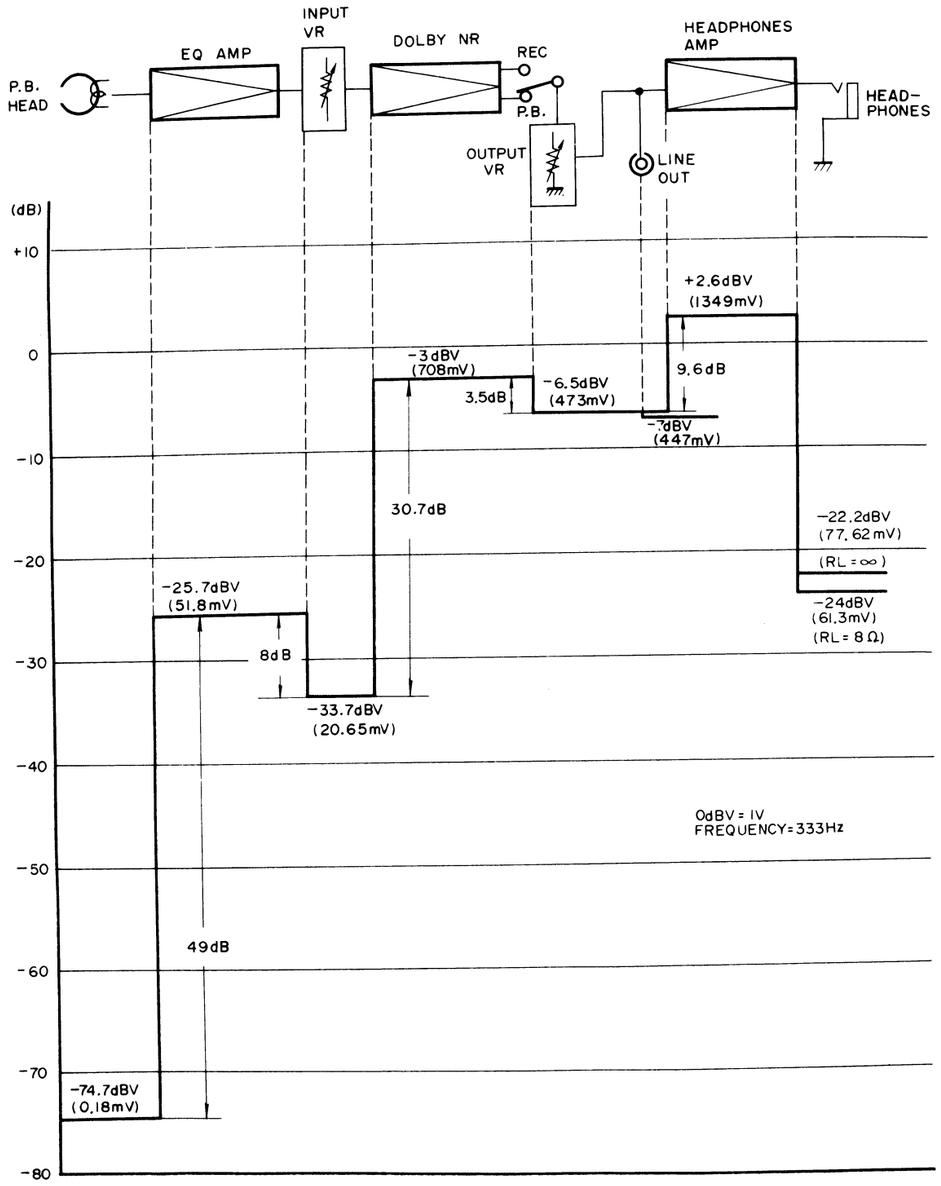
Depress this lever to stop the tape temporarily during recording or playback. When it is released, the tape will continue to travel as before. This lever is also depressed for unattended recording when the cassette deck is being used together with a timer.

3. BLOCK DIAGRAM

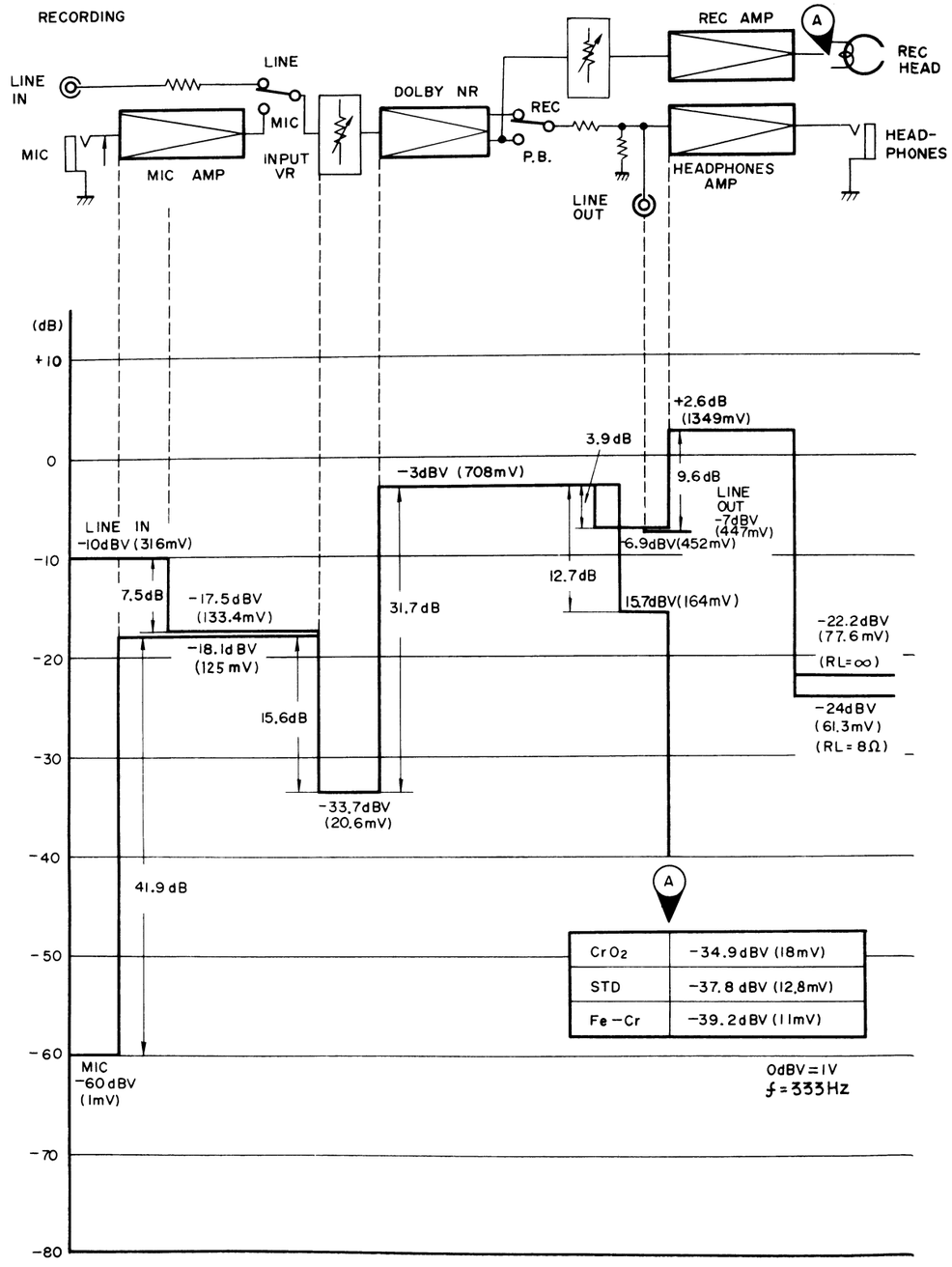


4. LEVEL DIAGRAM

PLAYBACK



RECORDING



CrO_2	−34.9dBV (18mV)
STD	−37.8 dBV (12.8mV)
Fe−Cr	−39.2dBV (11mV)

5. CIRCUIT DESCRIPTIONS

5.1 SIGNAL PATH

Playback

The signal path followed during playback is outlined in Fig. 1. S_2 is the recording/playback selector switch, and S_5 the DOLBY NR switch.

Recording

The signal path followed when recording is shown in Fig. 2, where S_4 is the MIC/LINE switch switches in the EQ amplifier when a microphone is plugged into the mic jack. The record input signal from the DIN-type connector will be applied to the EQ amplifier when there is no microphone plugged into the mic jack. S_3 is the DIN/LINE switch which switches the EQ amplifier into the input circuit when a DIN/LINE connector is used.

5.2 RECORDING AND PLAYBACK CIRCUITS

EQ Amplifier (Q_{301}, Q_{303} and Q_{305})

This is a 3-stage direct-coupled NFB amplifier equipped with 3 NPN transistors.

During recording, switching of the NFB circuit turns this amplifier into a mic (or DIN input) amplifier with a flat frequency response.

During playback, this NFB circuit is used as the playback equalizer amplifier (time constant circuit). Furthermore, the different time constants for STD and CrO_2 (FeCr) are switched over by the Q_{307} electronic switch. (For further details on the operation and control of this switch, see the section on the tape selector on page 11).

Muting Assembly (Q_{601}, Q_{602} and Q_{603})

When this set of NPN transistors (connecting the output of the flat amplifier to ground) is turned on, all unwanted noises (such as selector switching noise) are suppressed. During recording and playback, this set of transistors remains off. (For further details on the operation and control of the muting assembly, see the section on muting circuits on page 12).

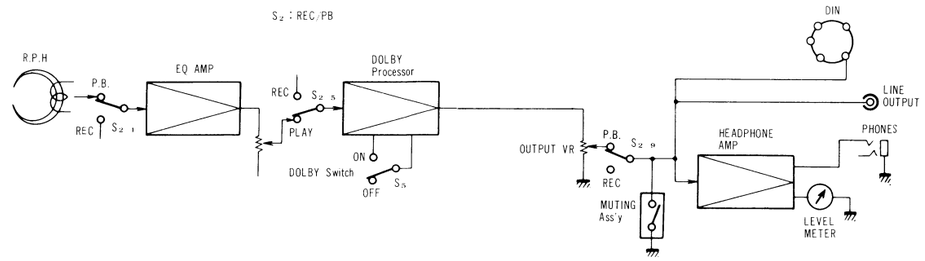


Fig. 1 Signal path during playback

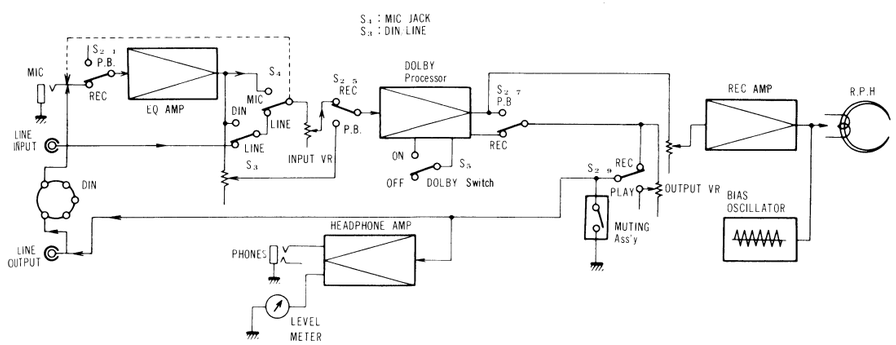


Fig. 2 Signal path during recording

Recording Amplifier (Q_{501} and Q_{502})

A 2-stage direct-coupled amplifier (employing a pair of NPN and PNP transistors), with a low-frequency booster in the NFB loop, a high-frequency booster peaking circuit at the emitter, and a recording bias leakage trap inserted in the output circuit.

The high-frequency booster peaking is switched to 3 different levels (STD, CrO_2 and FeCr) by 3 NPN transistor-type electronic switches, (For further details on switching action and control, see the section on the recording equalizer switching circuit on page 11).

Headphone Amplifier (Q_{101} and Q_{103})

This is a 2-stage direct-coupled amplifier consisting of 2 NPN transistors, and is employed for headphones and level meter drive. A matching transformer is included in the headphone output circuit.

DOLBY Processor

The CT-606 has a built-in DOLBY-B type noise reduction system. The B type DOLBY system has a noise reduction effect only in the mid and high frequency ranges. It gives a reduction in hiss noise during tape playback. The improvement in S/N at high frequency (above 5kHz) reaches a maximum of 10dB.

Figure 3 shows the configuration for the CT-606 DOLBY processor. During recording and playback, the same circuits are used, with appropriate change-over switching.

Operation During Recording

The input signal passes through amplifier (E), the MPX filter (I), and is fed to amplifier (A). The MPX filter (I) removes the multiplex signal from FM broadcasts, preventing malfunction of the system due to this signal.

The output from amplifier (A) is divided into two parts. One, being the main signal, is fed to the additive amplifier (D). The other, the sub-signal, is fed to the high pass filter (H), the variable attenuator (E), the amplifier (B), the clipper (G), from whence it is fed to the additive amplifier (D) where it is combined again with the main signal.

The output of amplifier (B) is, at the same time as it is fed to clipper (G), also fed to amplifier (C).

The output from amplifier (C) is converted to DC by the rectifier (F), and then fed back to the variable attenuator (E).

When the signal which passes through the high pass filter (H) is at a low level, the DC potential from the rectifier (F) is almost zero, and under these conditions the variable attenuator (E) provides its minimum attenuation. In this state, the additive amplifier (D) has an output which has a level some 10dB above the main signal (above 5kHz). The variation in attenuation in the variable attenuator (E) is effected by having an FET between the signal line and ground. The gate bias potential of the FET controls the impedance between the drain and source. The clipper (G) prevents defective operation due to over-shoot.

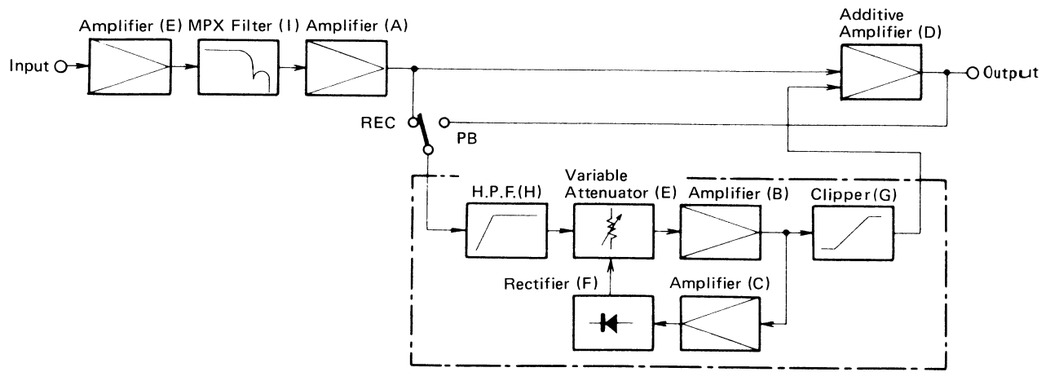


Fig. 3 Configuration of the Dolby processor

The latter necessity arises from the fact that the rectifier (F) has a time constant which makes it incapable of following extremely rapid changes in level, giving rise to over-shoot, which without the clipper would cause the system as a whole to operate defectively.

When the signal which passes the high pass filter (H) is at a high level, the DC potential from rectifier (F) will be high, and the attenuation of the variable attenuator (E) reaches its maximum.

Therefore, the sub-signal becomes almost zero, and the main signal level is not raised.

Operation During Playback

The MPX filter (I) becomes a low pass filter without the 19kHz attenuation peak. The operation of each of the other blocks is the same as it was during recording, with the exception that the sub-signal is derived from the output side of the additive amplifier (D). The additive amplifier (D) is an inverting amplifier (that is the phases of input and output are reversed), so that the sub-signal has the opposite phase, forming an NFB loop, that effectively performs subtraction. The operation for the sub-signal path is exactly the same as during recording. The only difference is the 180 degree phase reversal, so that playback and recording are perfectly complementary operations.

The B type DOLBY system compresses and expands signals below a certain level over a frequency band which is determined by the high pass filter (H). For this operation to be perfectly complementary, the standard level at the operating point must be determined. This critical level is known as the "DOLBY level," and this level is the limit beyond which the processor does not operate. In other words, for signals above this level, neither compression nor expansion takes place.

5.3 OSCILLATOR CIRCUIT

The oscillator circuit employed in this tape deck is of the push-pull type, and supplies the recording head with a recording bias current, and the erasing head with an erasing current (Oscillator frequency approximately 85kHz).

The advantage of push-pull-type oscillators is the reduction of even-numbered harmonics. There will, consequently, be no DC magnetization of the tape (which would result from the lack of positive-negative symmetry in the waveform due to the presence of even-numbered harmonics), and a reduction in the "whispering noise".

When the REC button is depressed, the recording/playback switch S_2 is switched to the REC position, resulting in +B being applied to the oscillator circuit (see Fig. 4). However, under these conditions, the muting switch S_9 will be in the stop position, and transistor Q_{201} will be kept off by −B, thereby preventing the oscillator from operation (only the amplifier stage will be ready for recording). Hence, the REC and PLAY buttons must be depressed together in order to switch the muting switch S_9 to the play position, and for Q_{201} to be turned on.

The CrO_2/STD (FeCr) recording bias switch changes the supply voltage applied to the oscillator circuit, thereby controlling the oscillation intensity.

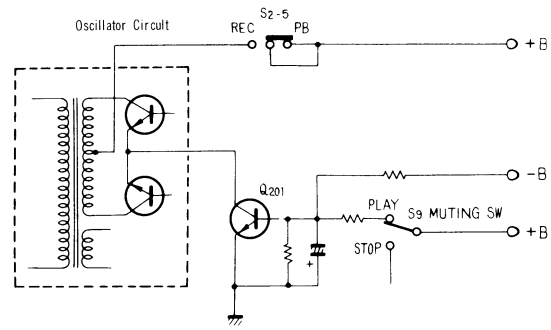


Fig. 4 Operational control of the oscillator circuit

5.4 POWER SUPPLY CIRCUIT

Independent transformer coils are provided for motor, lamps, and amplifier circuit power supplies.

The transistor and Zener diode are employed to eliminate the ripple component, and stabilize the supply voltage of the +B for the amplifier circuit.

The lamp power supply is employed for illumination of the cassette compartment and meters, and used as the −B for transistor switching (after half-wave rectification).

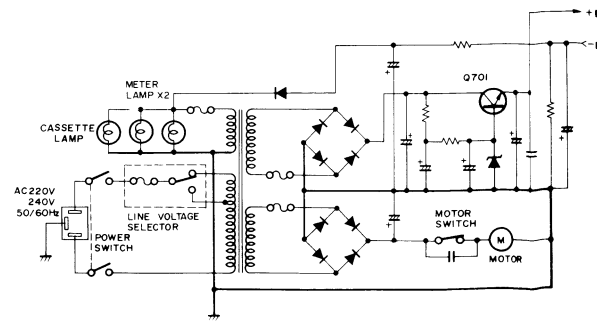


Fig. 5 Power supply circuit

5.5 CONTROL CIRCUITS

• Tape Selector

The CT-606 tape deck features switchable equalizer and bias circuits for CrO_2, FeCr, and standard tapes. This switching is performed either by the chrome-tape detector switch S_7, or by the front-panel tape selector switch S_6.

With no cassette tape loaded in the compartment, S_7 will be in the HOLE (CrO_2) position. The CrO_2 indicator lamp will thus light up irrespective of the S_6 position. So when an IEC standard chrome tape with automatic detector holes is loaded, S_7 will remain in the HOLE position ready for use with the chrome tape. If however, a cassette tape without the detector holes is loaded, S_7 will be switched to the NO HOLE position, and the CrO_2 indicator lamp will turn off. FeCr and standard tapes are selected by S_6 (with the FeCr indicator lamp lighting up when set to the FeCr position).

• Recording Bias Switching Circuit (Fig. 6)

The recording bias switch is a 2-position switch, one position being for CrO_2 tapes, and the other for FeCr and standard tapes. By changing the power supply voltage being applied to the bias oscillator circuit, the oscillation amplitude will be varied, thereby switching over the bias current.

When a cassette tape with no chrome detector holes is loaded (S_7 in the NO HOLE position), the +B oscillator. circuit power supply is passed via R_{207}. But when a cassette tape with the detector holes (I.E. chrome tape) is loaded, S_7 switches to the HOLE position, thereby adding the D_{203}, R_{206}, VR_{201} route in parallel to R_{207} to increase the voltage of the +B supply to the oscillator circuit. Hence, the recording bias for the CrO_2 position is greater than that for the FeCr and STD positions (increase of 20 to 30%).

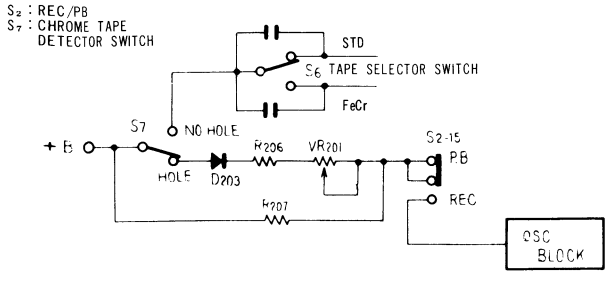


Fig. 6 Recording bias changeover circuit

• Playback Equalizer Circuit Switching Circuit (Fig. 7)

The playback equalizer switch is also a 2-position switch, one for CrO_2 and FeCr tapes, and the other for standard tapes. The CR connected to the output of the EQ amplifier is switched over by transistor switch.

When a cassette tape without chrome-tape detectors is loaded (S_7 in the NO HOLE position), and S_6 is in the STD position, there will be no +B applied to the base of Q_{307}. Therefore, the −B supply will turn this transistor off.

When S_7 is switched to the HOLE position (by inserting a cassette tape with chrome-tape detectors), or when S_6 is switched to the FeCr position, +B will be passed via D_{201} or D_{202}, thereby cancelling the −B, and turning Q_{307} on. C_{315} and R_{321} will thus be grounded, setting up the equalization circuit for CrO_2 and FeCr tapes. Note that the recording/playback switch S_2 ensures that +B can be applied to Q_{307} during playback mode only.

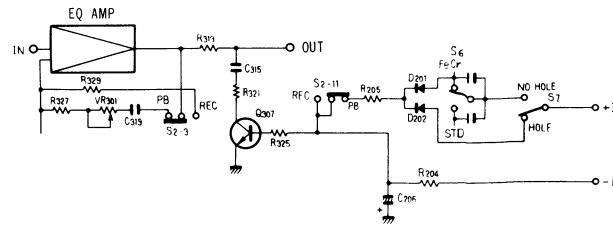
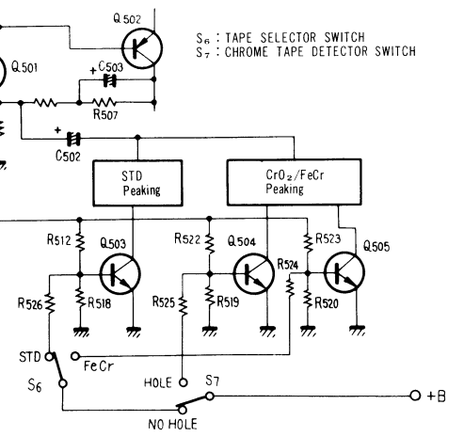


Fig. 7 Playback equalizer circuit

• Recording Equalizer (Peaking) Switching Circuit (Fig. 8)

The REC amplifier is a 2-stage direct-coupled amplifier consisting of a pair of PNP and NPN transistors. The high-frequency peaking required during recording is achieved by means of the series resonance circuit connected to the emitter of Q_{501}.

The level of peaking is changed by the 3-position switching circuit which connects the peaking elements via Q_{503} (turned on in STD position). Q_{504} (turned on in CrO_2 position), or Q_{505} (turned on in FeCr position). The +B supply is applied to the base of any one of these transistors, depending on the positions selected by the tape selector switch S_6 and the chrome-tape detector switch S_7. The −B supply will thus be cancelled, thereby turning the relevant transistor on, and activating the corresponding peaking circuit. The peaking frequency for standard tapes is approx. 13.5kHz, while that for CrO_2 and FeCr tapes is approx. 15kHz.

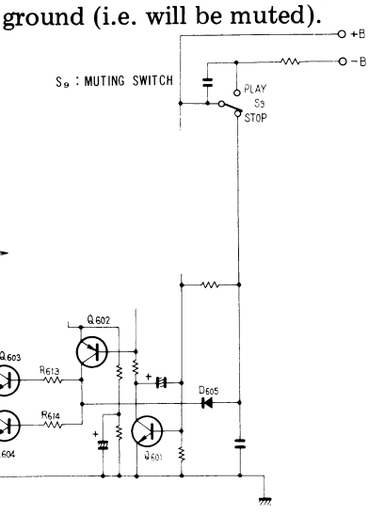


Recording equalizer changeover circuit

NG CIRCUITS

TOP, FF, or REW Buttons Operated

e STOP, FF, or REW button is de-
e muting switch S_9 is switched to the
n. +B will thus be passed via S_9, D_{605},
to apply a positive bias to Q_{603}(Q_{604}).
ransistor is turned on, the signal current
ground (i.e. will be muted).



g circuit (When STOP, FF or REW buttons
ted)

AY button is Operated (Fig. 10)

e PLAY button or both the REC and
ons are depressed, the muting switch S_9
to the play position, thereby turning
cutting off the bias (+B). At the same
vill be turned off also due to +B applied
while Q_{603} (Q_{604}) will be turned off by
plied to its base.

However, in order to eliminate the switching "pop" noise, a positive bias is applied to Q_{601} by means of the C_{602} (quick charging capacitor) charge current. Q_{601} will thus be turned on, followed by Q_{602} and Q_{603} (Q_{604}) also turning on to short-circuit the signal circuit. The muting circuit will remain on for approx. 0.4 sec. after the muting switch S_9 is switched to the play position.

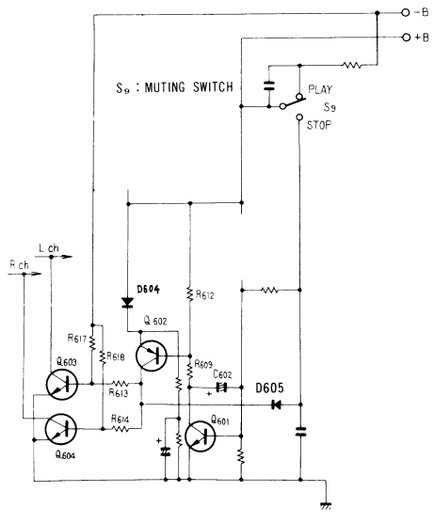


Fig. 10 Muting circuit (When PLAY button is operated)

• When Power Supply is Switched On or Off

When the power supply switch is turned on, +B will flow via C_{601} and R_{603} for the short period it requires for C_{601} to fully charge up, thereby turning Q_{601} on by the positive bias. Q_{602} and Q_{603} (Q_{604}) will also be turned on in succession, thereby activating the muting circuit. The muting period in this case (approx. 4.5 sec.) is determined by the C_{601}/R_{603} time constant (Fig. 11).

Prior to turning the power supply off again, +B will be applied to the base of Q_{602} (which will thus be turned off), but C_{605} will be fully charged by +B applied via D_{604} and R_{615} (see Fig.12).When the power supply switch is then turned off, +B will no longer be applied to the base of Q_{602}. The Q_{602} base voltage will quickly fall to zero by the D_{602}, R_{610}, R_{605}, $S_{2\text{-}16}$ to ground route if in recording mode. The emitter voltage of Q_{602} will be maintained by the charge on C_{605}, thereby turning this transistor on. Q_{603} (Q_{604}) will also be turned on, thereby activating the muting circuit and preventing the generation of any "click" noise.

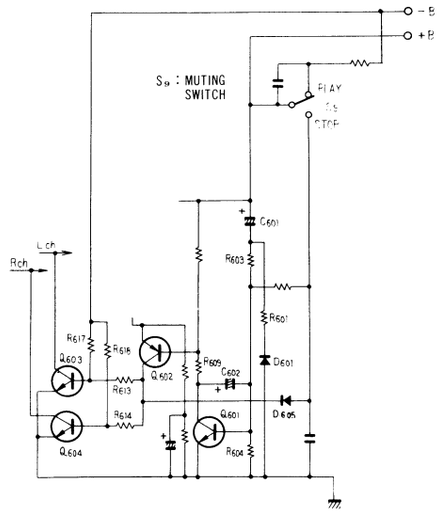


Fig. 11 Muting circuit (When power supply is switched ON)

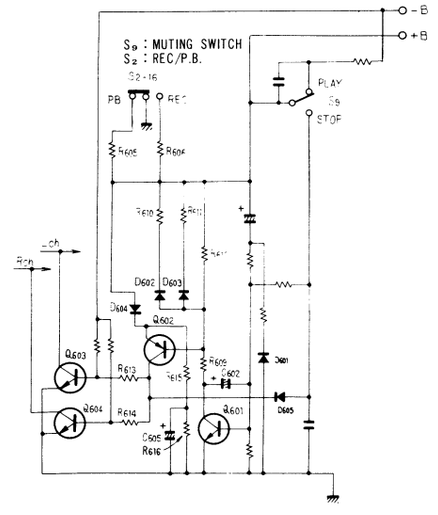


Fig. 12 Muting circuit (When power supply is switch OFF)

• When REC Button is Depressed During PLAY Mode (Fig. 13)

The CT-606 tape deck is also designed to mute out the click noise caused when recording mode is commenced during play mode (due to the switching action of the REC/PB switch).

When this REC/PB switch switches from the playback position to the recording position, the Q_{602} base potential will be lowered (the D_{603}, C_{604}, R_{608}, $S_{2\text{-}16}$ to ground route) during the short time required for C_{604} to be fully charged. Q_{602} will thus be turned on for a moment, as will Q_{603} (Q_{604}) and the muting circuit. The muting period (approx. 0.5 sec.) is determined by the C_{604}/R_{608} time constant.

In addition, when the REC/PB switch is switched back to the playback position from the recording position, Q_{602} will again be turned on during the short period required to fully charge up C_{603} via the D_{602}, C_{603}, R_{607}, $S_{2\text{-}16}$ to ground route. The muting circuit is thus activated in the same way and for the same period of time as before.

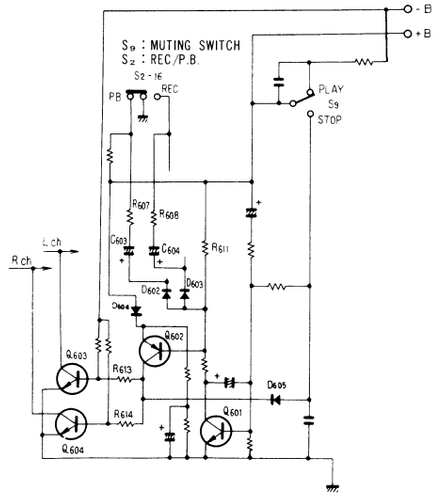


Fig. 13 Muting circuit (When REC button is depressed during PLAY mode)

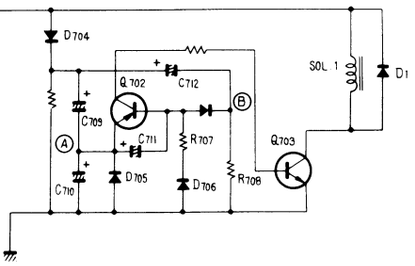
5.7 AUTO START CIRCUIT

This circuit is designed to release the tape deck from the pause mode automatically when the power supply is turned on (see Fig. 14).

When the power supply is turned on, both C_{709} and C_{710} are charged up rapidly, with the potential at point (A) rising very quickly to a constant value. The potential at point (B) decreases while capacitor C_{712} is being charged up via R_{708}, but it will still be higher than the potential at point (A). Consequently, Q_{702} and Q_{703} will both be turned off, and no current will flow through solenoid SOL. 1.

When the potential at point (B) finally drops below that of point (A) (while C_{712} continues to be charged up), C_{711} will start to charge up, and transistor Q_{702} will turn on. The charge in C_{710} will thus be discharged as the base current of Q_{703}, which will consequently be turned on by the positive bias applied to it. Current will flow through SOL. 1 as a result, thereby releasing the PAUSE

When C_{710} is almost completely dis- potential at point (A) will have st to 0V, whereupon Q_{702} and Q_{703} off.



ig. 14 Auto start circuit

6. MECHANISM SECTION OPERATION

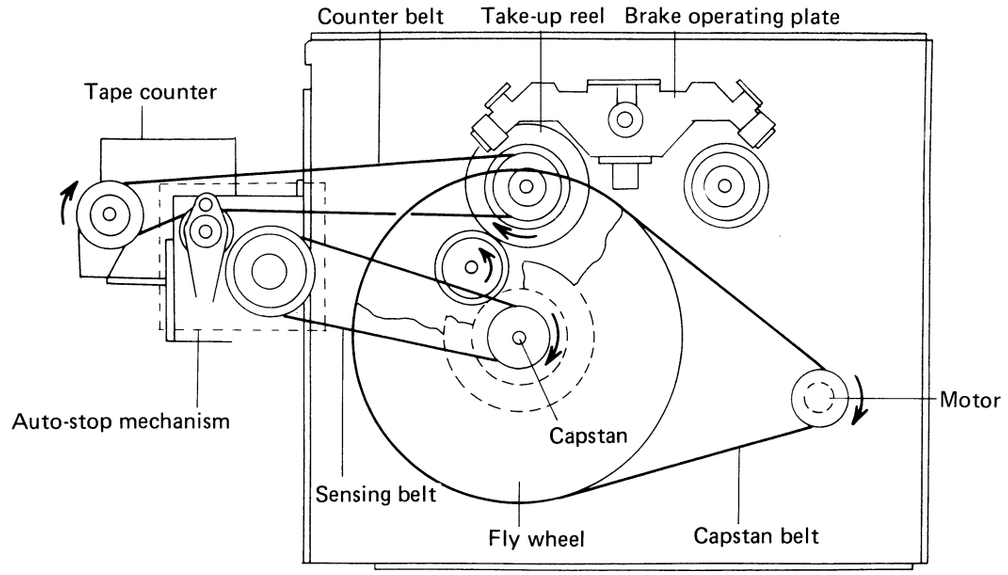


Fig. 15 Play operation

PLAY OPERATION (Fig. 15)

When the power switch is set to the ON position and the PLAY button is pushed, the brake operating plate is released, the motor switch is turned ON, and the motor rotates.

When the motor rotates, the flywheel is turned by the capstan belt. The capstan at the end of the flywheel shaft pushes the tape against the pinch roller and the tape is fed at a constant speed.

The fed tape is wound onto the take-up reel by rotation of the take-up reel base by the idler from the center of the flywheel shaft.

Simultaneously, the rotation of the take-up base drives the tape counter through a belt called the "counter belt."

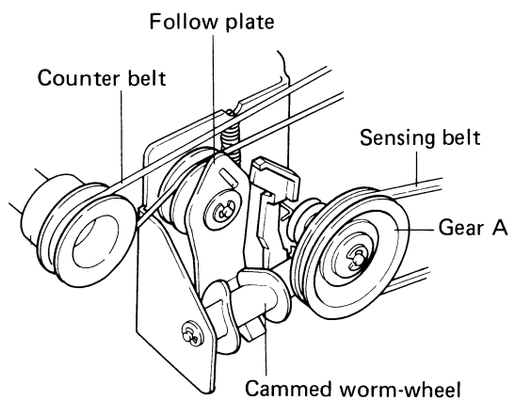


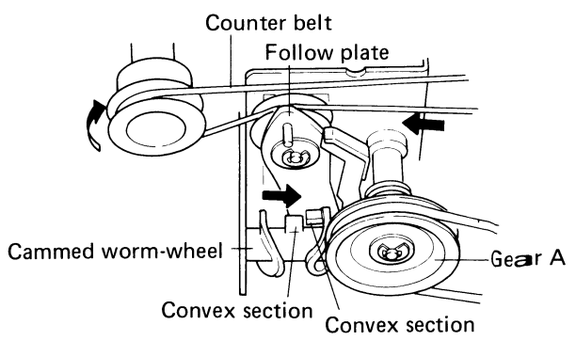
Fig. 16

AUTO-STOP OPERATION (Fig. 16, 17)

The auto-stop mechanism comprises a follow plate, cammed worm-wheel and gear A as illustrated in Fig. 17, and is installed at the center of the counter belt.

Gear A is connected to the flywheel by a belt and is constantly rotated while the flywheel rotates. Gear A is engaged with the cammed worm-wheel and rotates it.

There is a convex section at the center of the cammed worm-wheel, A cam is installed at the left and right sides of this convex section. There is also a convex section at the end of the follow plate. The follow plate is pushed against the left cam (right cam at FF) by the friction of the counter belt while the belt is rotating. This prevents the



F ig. 17

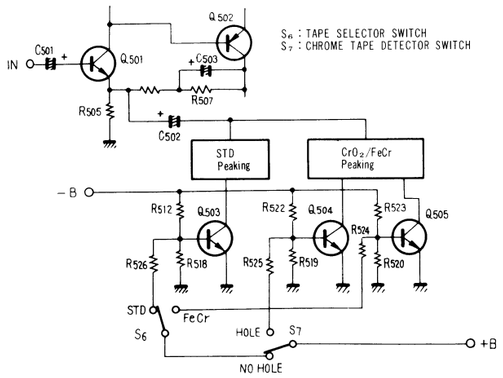


Fig. 8 Recording equalizer changeover circuit

5.6 MUTING CIRCUITS

- **When STOP, FF, or REW Buttons Operated (Fig. 9)**

When the STOP, FF, or REW button is depressed, the muting switch S_9 is switched to the stop position. +B will thus be passed via S_9, D_{605}, R_{613} (R_{614}) to apply a positive bias to Q_{603}(Q_{604}). Once this transistor is turned on, the signal current will flow to ground (i.e. will be muted).

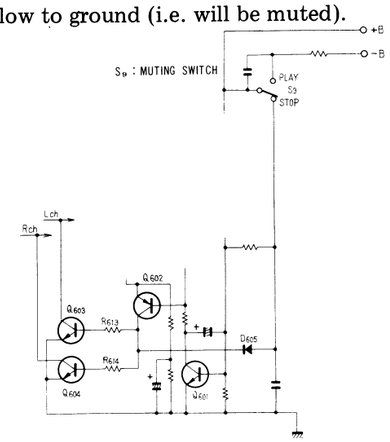


Fig. 9 Muting circuit (When STOP, FF or REW buttons operated)

- **When PLAY button is Operated (Fig. 10)**

When the PLAY button or both the REC and PLAY buttons are depressed, the muting switch S_9 is switched to the play position, thereby turning Q_{601} off by cutting off the bias (+B). At the same time, Q_{602} will be turned off also due to +B applied to its base while Q_{603} (Q_{604}) will be turned off by -B being applied to its base.

However, in order to eliminate the switching "pop" noise, a positive bias is applied to Q_{601} by means of the C_{602} (quick charging capacitor) charge current. Q_{601} will thus be turned on, followed by Q_{602} and Q_{603} (Q_{604}) also turning on to short-circuit the signal circuit. The muting circuit will remain on for approx. 0.4 sec. after the muting switch S_9 is switched to the play position.

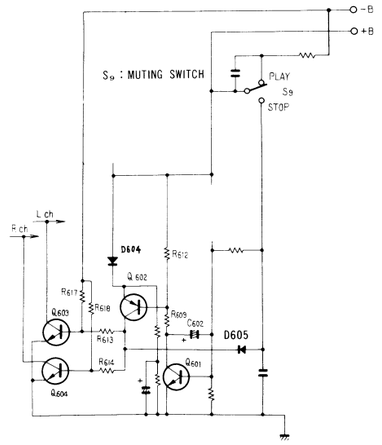


Fig. 10 Muting circuit (When PLAY button is operated)

- **When Power Supply is Switched On or Off**

When the power supply switch is turned on, +B will flow via C_{601} and R_{603} for the short period it requires for C_{601} to fully charge up, thereby turning Q_{601} on by the positive bias. Q_{602} and Q_{603} (Q_{604}) will also be turned on in succession, thereby activating the muting circuit. The muting period in this case (approx. 4.5 sec.) is determined by the C_{601}/R_{603} time constant (Fig. 11).

Prior to turning the power supply off again, +B will be applied to the base of Q_{602} (which will thus be turned off), but C_{605} will be fully charged by +B applied via D_{604} and R_{615} (see Fig.12).When the power supply switch is then turned off, +B will no longer be applied to the base of Q_{602}. The Q_{602} base voltage will quickly fall to zero by the D_{602}, R_{610}, R_{605}, $S_{2\text{-}16}$ to ground route if in recording mode. The emitter voltage of Q_{602} will be maintained by the charge on C_{605}, thereby turning this transistor on. Q_{603} (Q_{604}) will also be turned on, thereby activating the muting circuit and preventing the generation of any "click" noise.

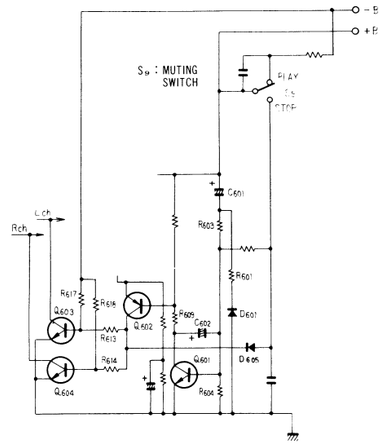


Fig. 11 Muting circuit (When power supply is switched ON)

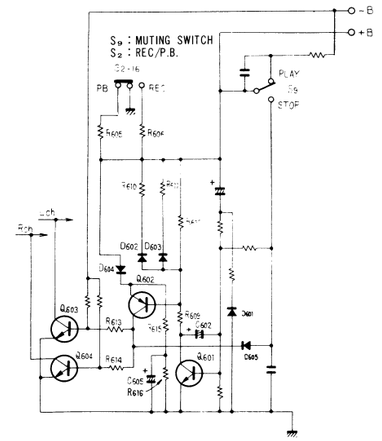


Fig. 12 Muting circuit (When power supply is switch OFF)

- **When REC Button is Depressed During PLAY Mode (Fig. 13)**

The CT-606 tape deck is also designed to mute out the click noise caused when recording mode is commenced during play mode (due to the switching action of the REC/PB switch).

When this REC/PB switch switches from the playback position to the recording position, the Q_{602} base potential will be lowered (the D_{603}, C_{604}, R_{608}, $S_{2\text{-}16}$ to ground route) during the short time required for C_{604} to be fully charged. Q_{602} will thus be turned on for a moment, as will Q_{603} (Q_{604}) and the muting circuit. The muting period (approx. 0.5 sec.) is determined by the C_{604}/R_{608} time constant.

In addition, when the REC/PB switch is switched back to the playback position from the recording position, Q_{602} will again be turned on during the short period required to fully charge up C_{603} via the D_{602}, C_{603}, R_{607}, $S_{2\text{-}16}$ to ground route. The muting circuit is thus activated in the same way and for the same period of time as before.

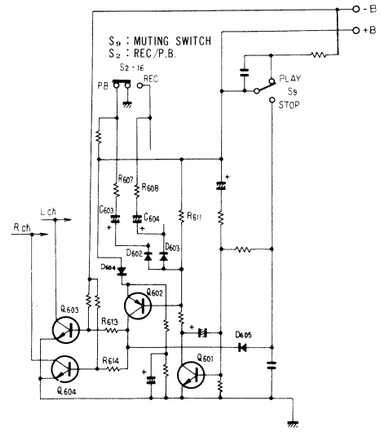


Fig. 13 Muting circuit (When REC button is depressed during PLAY mode)

5.7 AUTO START CIRCUIT

This circuit is designed to release the tape deck from the pause mode automatically when the power supply is turned on (see Fig. 14).

When the power supply is turned on, both C_{709} and C_{710} are charged up rapidly, with the potential at point (A) rising very quickly to a constant value. The potential at point (B) decreases while capacitor C_{712} is being charged up via R_{708}, but it will still be higher than the potential at point (A). Consequently, Q_{702} and Q_{703} will both be turned off, and no current will flow through solenoid SOL. 1.

When the potential at point (B) finally drops below that of point (A) (while C_{712} continues to be charged up), C_{711} will start to charge up, and transistor Q_{702} will turn on. The charge in C_{710} will thus be discharged as the base current of Q_{703}, which will consequently be turned on by the positive bias applied to it. Current will flow through SOL. 1 as a result, thereby releasing the PAUSE

button lock. When C_{710} is almost completely discharged, the potential at point (A) will have dropped almost to 0V, whereupon Q_{702} and Q_{703} will both turn off.

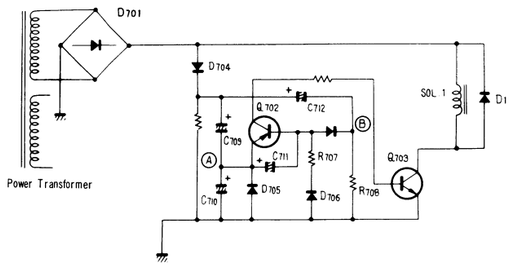


Fig. 14 Auto start circuit

6. MECHANISM SECTION OPERATION

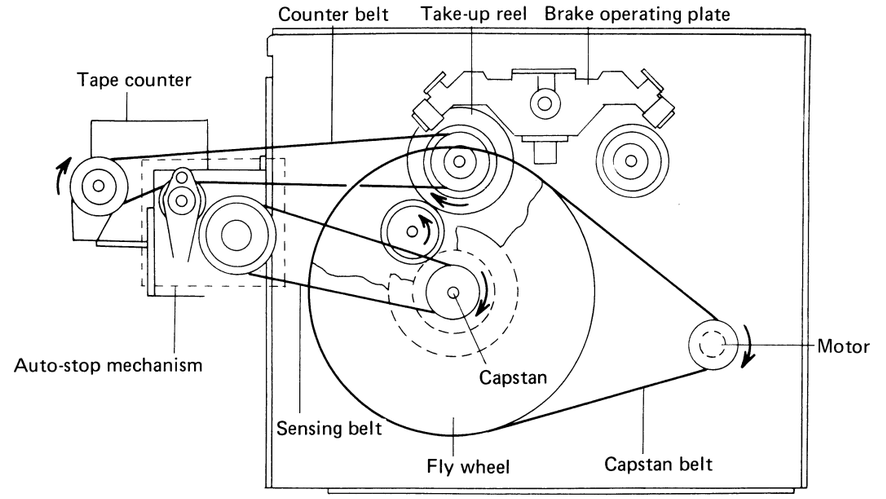


Fig. 15 Play operation

PLAY OPERATION (Fig. 15)

When the power switch is set to the ON position and the PLAY button is pushed, the brake operating plate is released, the motor switch is turned ON, and the motor rotates.

When the motor rotates, the flywheel is turned by the capstan belt. The capstan at the end of the flywheel shaft pushes the tape against the pinch roller and the tape is fed at a constant speed.

The fed tape is wound onto the take-up reel by rotation of the take-up reel base by the idler from the center of the flywheel shaft.

Simultaneously, the rotation of the take-up base drives the tape counter through a belt called the "counter belt."

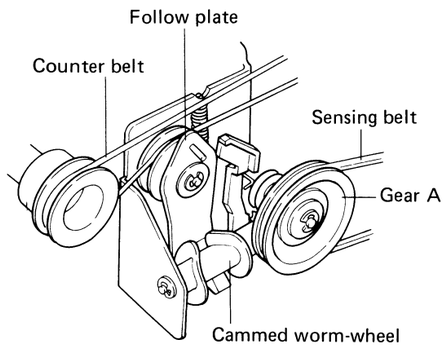


Fig. 16

AUTO-STOP OPERATION (Fig. 16, 17)

The auto-stop mechanism comprises a follow plate, cammed worm-wheel and gear A as illustrated in Fig. 17, and is installed at the center of the counter belt.

Gear A is connected to the flywheel by a belt and is constantly rotated while the flywheel rotates. Gear A is engaged with the cammed worm-wheel and rotates it.

There is a convex section at the center of the cammed worm-wheel, A cam is installed at the left and right sides of this convex section. There is also a convex section at the end of the follow plate. The follow plate is pushed against the left cam (right cam at FF) by the friction of the counter belt while the belt is rotating. This prevents the

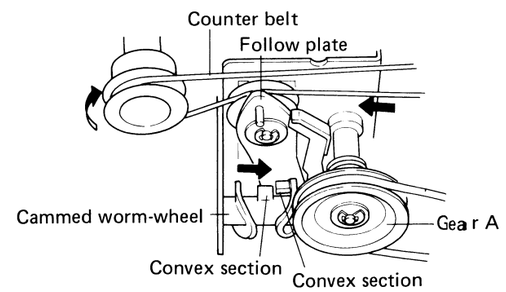


Fig. 17

convex section of the cammed worm-wheel from engaging the convex section of the follow plate while the counter belt is rotating.

When the counter belt is halted by the stopping of the rotation of the take-up reel base by tape winding, the follow plate is no longer pushed to the left. The cammed worm-wheel continues to rotate and the convex section of the follow plate is guided at the center between the left and right cams. Furthermore, the cammed worm-wheel is rotated and the convex section of the worm-wheel engages the convex section of the follow plate (Fig. 18).

The engaged follow plate is, therefore, depressed. This operates the set arm, the release lever is operated by the connection wire, and the operation button (PLAY button) is released. When the operation button is released, the brake operating plate drops, the motor switch is turned OFF, and the rotation of the motor is halted (Fig. 19).

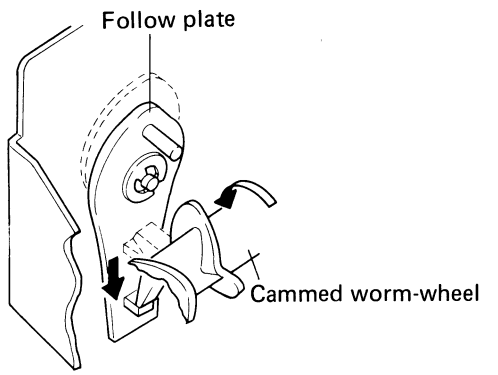


Fig. 18

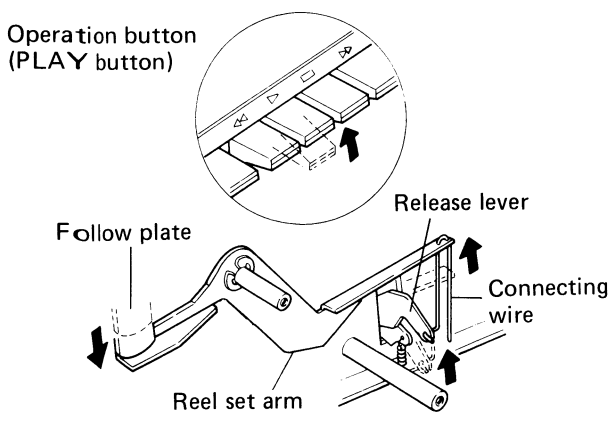


Fig. 19

FF, REW, OPERATION

At FF operation, the take-up reel base is not rotated thru the take-up, but is rotated by the FF idler from the flywheel; the pinch roller is separated from the capstan, and the tape is wound at high speed. At REW operation, the supply base is rotated by the REW idler from the motor pulley; so the take-up reel, counter belt, and counter are rotated in the opposite direction to that at FF and PLAY, and the auto-stop mechanism is pushed to the right. However, while the counter belt is rotating, the follow plate is again pushed against the cam at the side opposite to that at FF and PLAY, and the convex section of the follow plate is not engaged with the convex section of the worm-wheel.

After the tape has been rewound, the counter belt is stopped, and the convex section of the follow plate is guided at the center between the worm-wheel cams and is engaged with the convex section of the cammed worm-wheel; the operation button (FF or REW button) is released and the motor is stopped in the same way as in the auto-stop operation described previously.

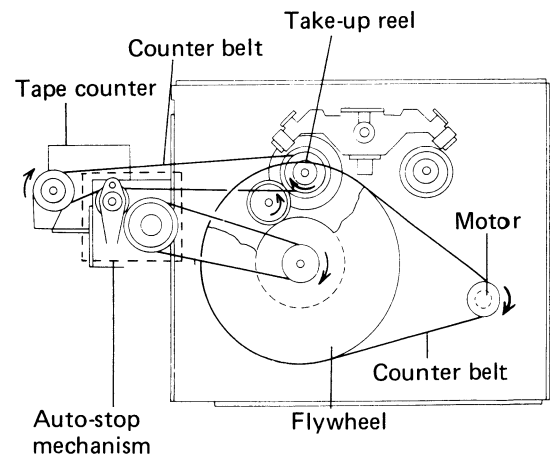


Fig. 20 FF operation

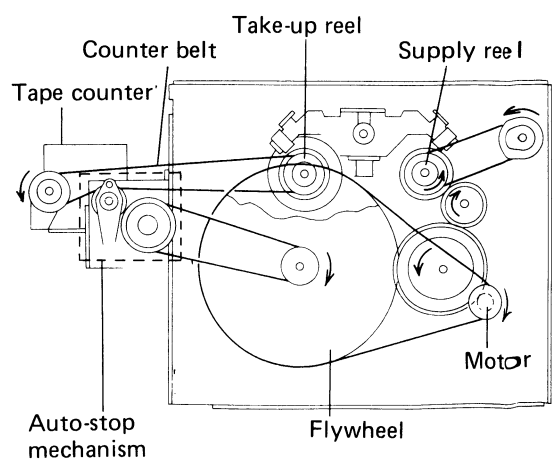


Fig. 21 REW operation

7. DISASSEMBLY

EXTERIOR PARTS

1. Remove the two mounting screws at the left and right sides of the bonnet, and remove it (Fig. 22).

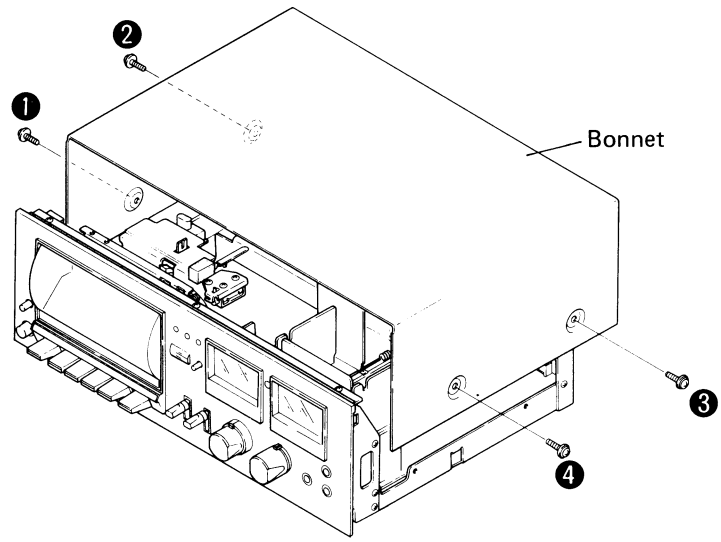


Fig. 22

2. Remove the front panel knobs and the six front panel mounting screws, three at the top and three at the bottom, and remove the front panel (Fig. 23).

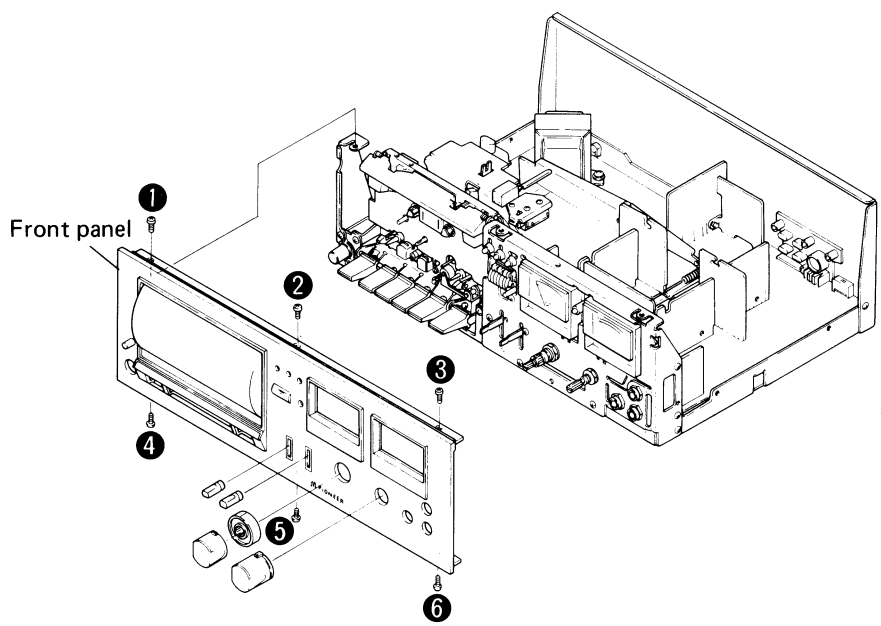


Fig. 23

MECHANISM SECTION

Remove the three mounting screws at the front and the two at the top of the mechanism section, and remove the section (Fig. 24).

Remove the two mounting screws at the front of the mechanism section, and remove the cassette plate (Fig. 25).

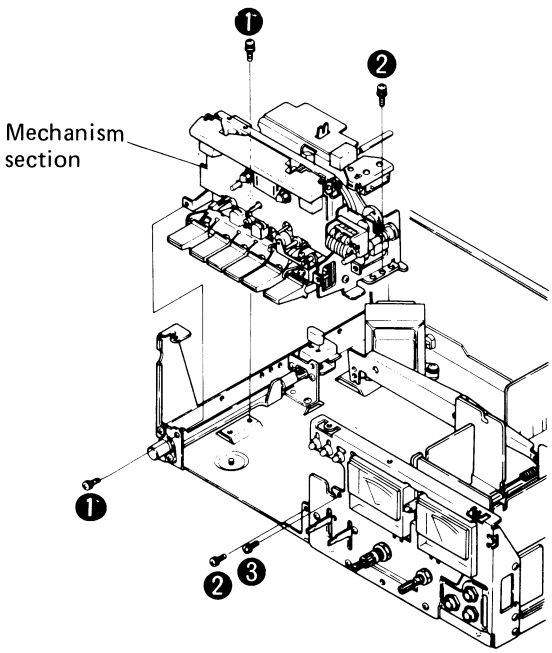


Fig. 24

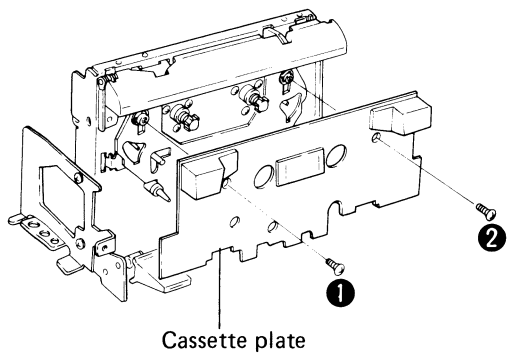


Fig. 25

REC/PB HEAD

Remove the two mounting screws, disconnect the REC/PB head leads, and remove the REC/PB head. Be sure to adjust the electrical system after the REC/PB head has been reinstalled (Fig. 26).

ERASING HEAD

Remove the two mounting screws and the lead wire clamp, disconnect the erasing head leads, and remove the erasing head (Fig. 26).

PINCH ARM

Remove the E-washer and nylon washer and pull the pinch arm out while pushing the pinch pressure spring down (Fig. 26).

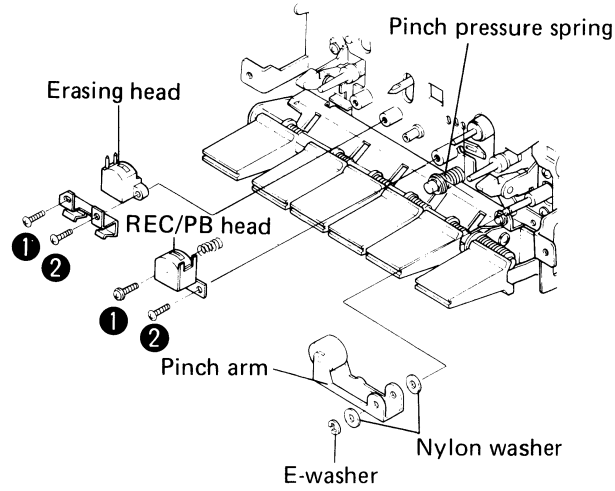


Fig. 26

SUBCHASSIS

Be careful not to get any oil or grease on the belt. Next, remove the four mounting screws, and the subchassis (Fig. 27).

BELT

After the subchassis has been removed, pull the flywheel ass'y out and remove it, along with the capstan belt, being careful not to lose the grease washer at the front of the mechanism section. Be careful not to get any oil or grease on the belt when removing it (wear gloves). Both sides of the capstan belt are polished and it has on specific front or back.

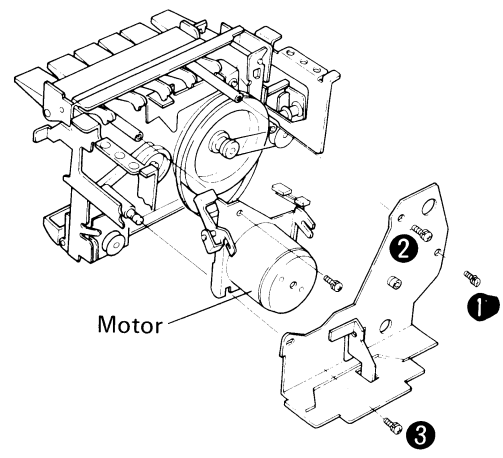
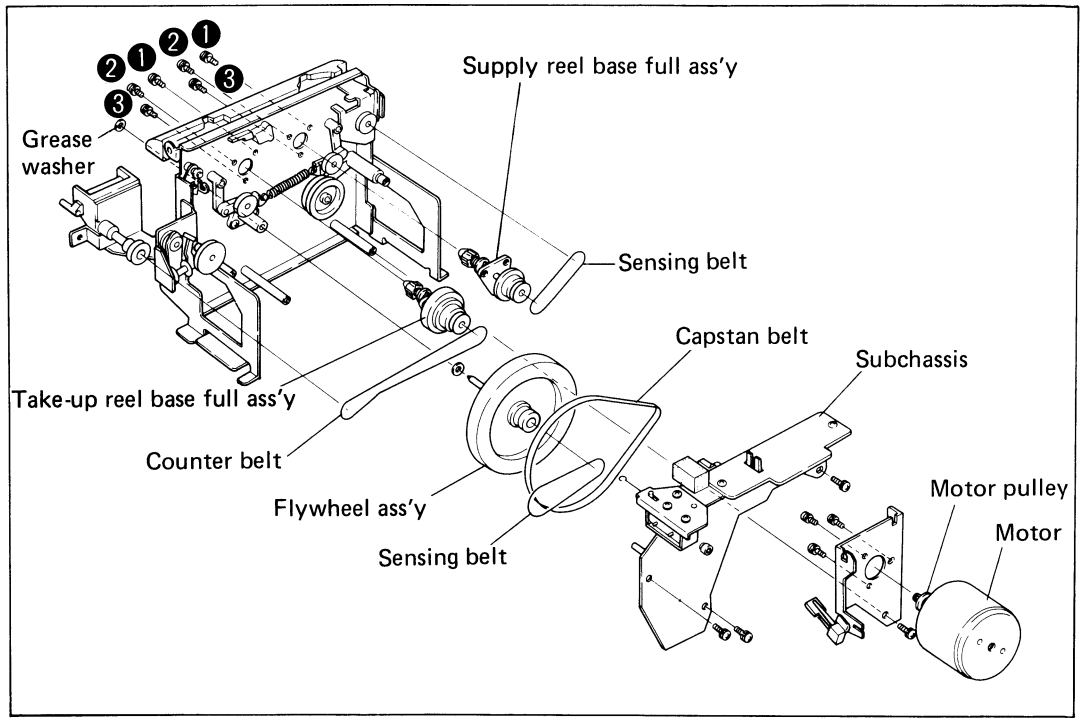


Fig. 27



SUPPLY REEL BASE FULL ASSEMBLY

After removing the subchassis, remove the sensing belt, the three mounting screws, and the supply reel base full ass'y.

TAKE-UP REEL BASE FULL ASSEMBLY

After the subchassis has been removed, remove the sensing belt, the three mounting screws, and the take-up reel base full ass'y.

MOTOR

When installing the motor pulley to the motor shaft, adjust the clearance between the motor and pulley to 1.7mm ±0.5mm (using a spacer), securely tighten the set-screw and lock it (Fig. 28).

At this time, be careful not to apply unnecessary force to the motor shaft.

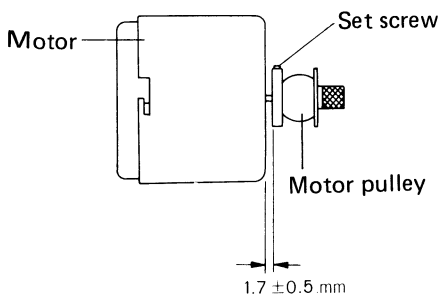


Fig. 28

LUBRICATION THE CAPSTAN

Slowly pull the bearing from the flywheel, hold the flywheel so that the capstan shaft is at the top, and lubricate the shaft with 1—2 drops of oil, being careful that none of the oil gets on parts other than the capstan shaft (Fig. 29).

Use General Turbine Oil No.30 (Part No. GME-001). After lubricating, insert the bearing washer onto the capstan shaft and slowly insert the bearing. Clean the part of the capstan shaft protruding from the bearing with dyflon (or absolute alcohol) and insert the grease washer onto the shaft.

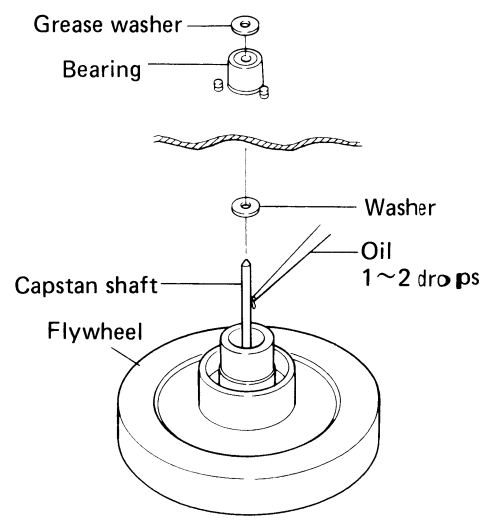


Fig. 29

PUSH-BUTTONS

Heat the button to be removed with a hair dryer or other similar implement (to loosen the bond), and pull the button off (Fig. 30).

When installing the buttons, coat the front end of the lever with Bond 575, and then firmly push the button completely over the lever.

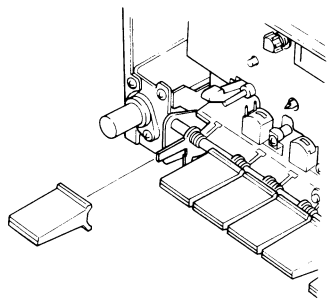


Fig. 30

WIRING PRECAUTIONS

When disassembling or replacing an ass'y, always pass the wiring of the REC/PB head between the REC/PB selector switch mounted to the center of the mother ass'y (Fig. 31).

If this wire is passed thru at another point, the S/N ratio will deteriorate noticeably.

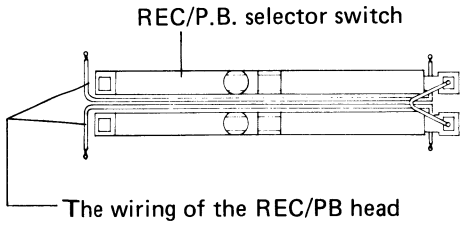


Fig. 31

REPLACING THE METER LAMP

Remove the tape as illustrated in Fig. 32, and remove the meter cover. When replacing the lamp be careful not to touch the meter pointer or other parts.

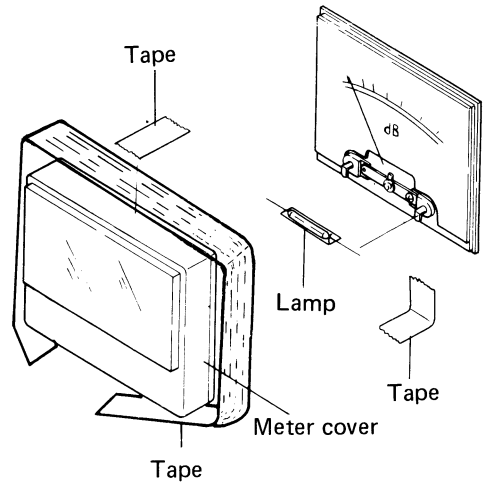
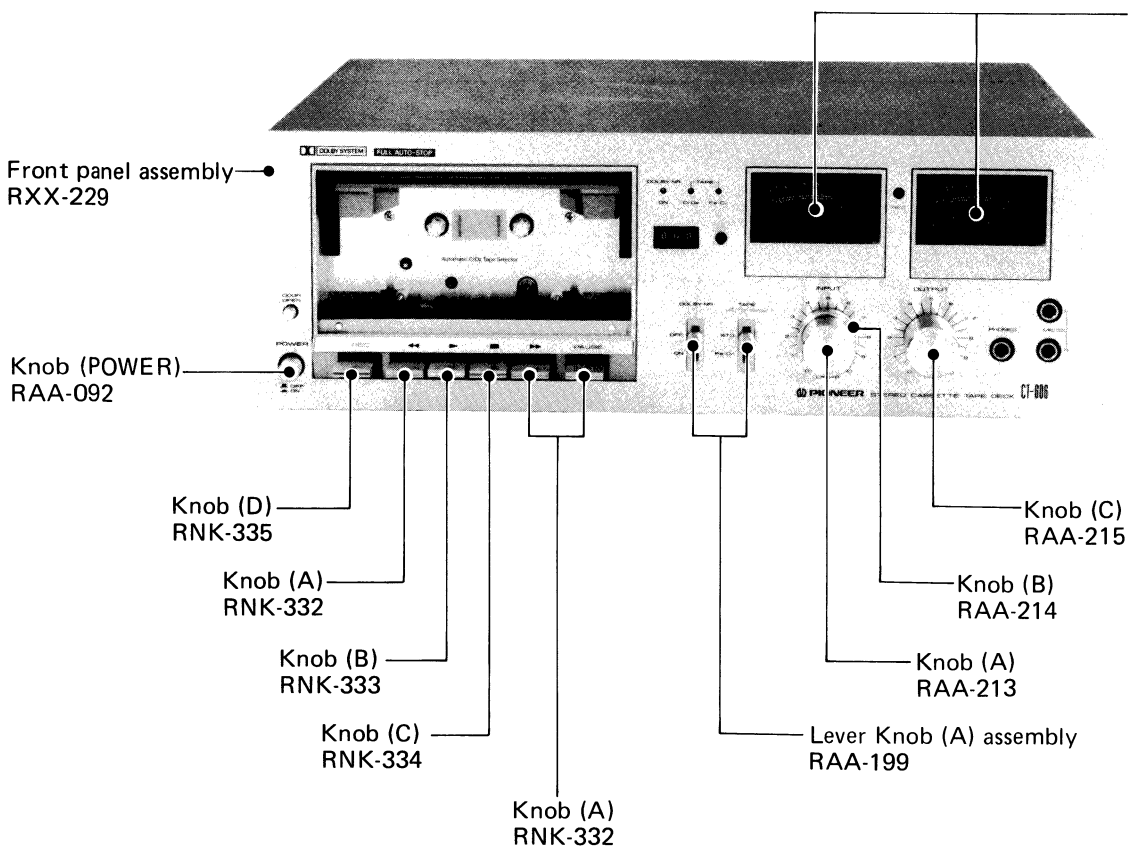


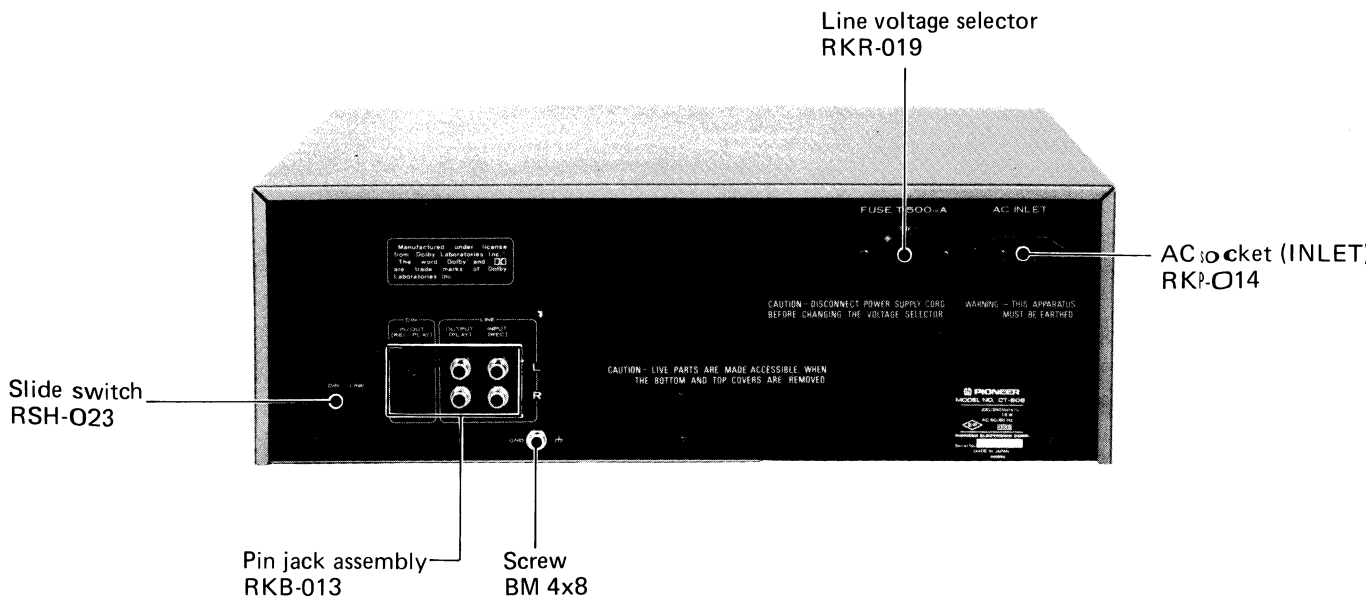
Fig. 32

8. PARTS LOCATION

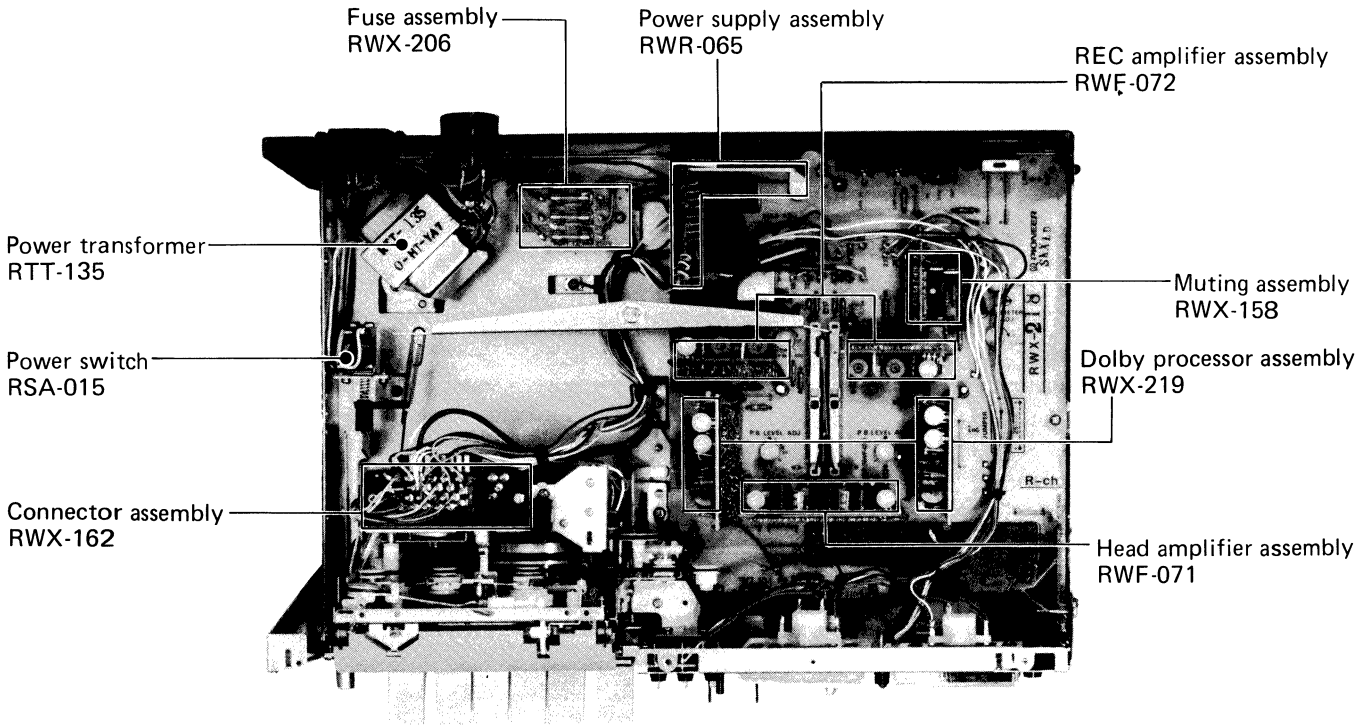
8.1 FRONT PANEL VIEW



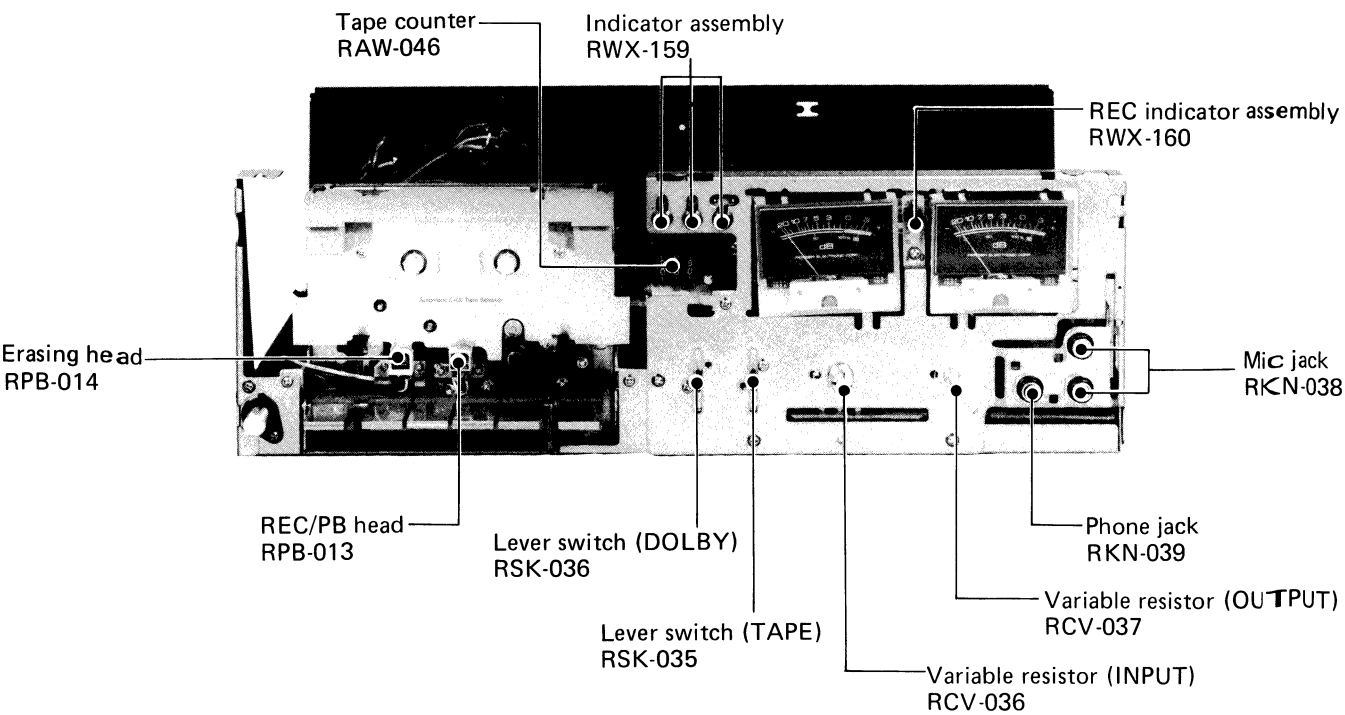
8.2 REAR PANEL VIEW



8.3 TOP VIEW



8.4 FRONT VIEW WITH PANEL REMOVED



9. MECHANICAL ADJUSTMENTS

Normally, perform adjustment with the mechanism section removed from the body (However, do not disconnect the wiring).

The mechanism section adjustment points are shown in Fig. 33.

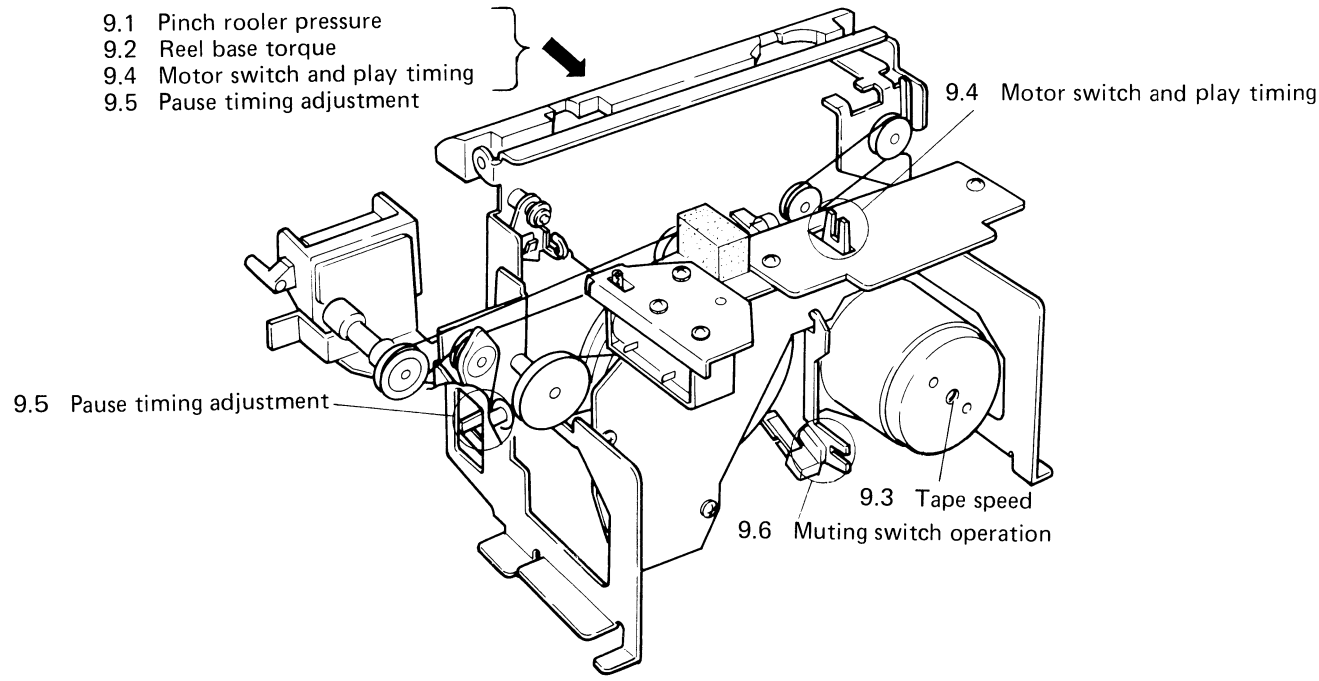

9.1 Pinch rooler pressure
9.2 Reel base torque
9.4 Motor switch and play timing
9.5 Pause timing adjustment
9.4 Motor switch and play timing
9.5 Pause timing adjustment
9.3 Tape speed
9.6 Muting switch operation

Fig. 33 Mechanism adjustment points

WOW AND FLUTTER

When rotation irregularities have increased noticeably, check the following items and clean, adjust or replace the faulty parts, as required:

1. Capstan bent, worn-out, soiling
2. Pinch roller soiling, unsuitable pressure
3. Flywheel thrust play*
4. Capstan belt soiling, deterioration
5. Take-up idler soiling, eccentricity, unsuitable pressure
6. Take-up reel base irregular torque
7. Excessive back tension
8. Rotation of sensing switch not smooth
9. Operation of tape counter not smooth
10. Cassette (tape faulty)

* Simple thrust adjustment

Slowly thread in the thrust adjusting screw until there is no more flywheel play, back-off the screw 90° (being careful not to thread in the screw so far that the flywheel does not rotate), confirm that the flywheel rotates smoothly and then lock the adjusting screw with a screw locking solution.

9.1 PINCH ROLLER PRESSURE

1. Push the PLAY button, push a tension gauge (500g/full scale) against the part indicated by the arrow in Fig. 34, push the pinch roller away from the capstan (about 1—2mm) and slowly return the pinch arm and measure the torque at the point at which the pinch roller begins to rotate.
2. When the measured value is outside the 280g—360g range, increase or decrease the pressure, as required, by re-hooking the pinch pressure spring.
3. When the pinch roller pressure is still outside the 280g—360g range even after the adjustment of item 2 above, replace the pinch pressure spring (RBH-278).
4. When replacing the pinch pressure spring insert the hook of the spring into the rectangular hole of the head base while passing the spring thru the pinch spring shaft.
   If the spring is installed in the opposite way, it may be deformed. Moreover, be careful not to damage the pinch roller with the end of the spring when mounting the spring.

9.2 REEL BASE TORQUE

Measure the torque of the reel base at PLAY, FF, and REW. A value within the ratings given in the separate table is normal.

When the measured values are outside the rated values, clean the idlers, reel bases and other roller contact parts and measure the torque again. When the measured values are still outside the rated values, replace the reel base and re-check the torque.

	Take-up reel base	Supply reel base
At PLAY	30—45g·cm	* 6g·cm or less
At FF	70—100g·cm	* 6g·cm or less
At REW	* 7g·cm or less	70—100g·cm

* Back tension torque

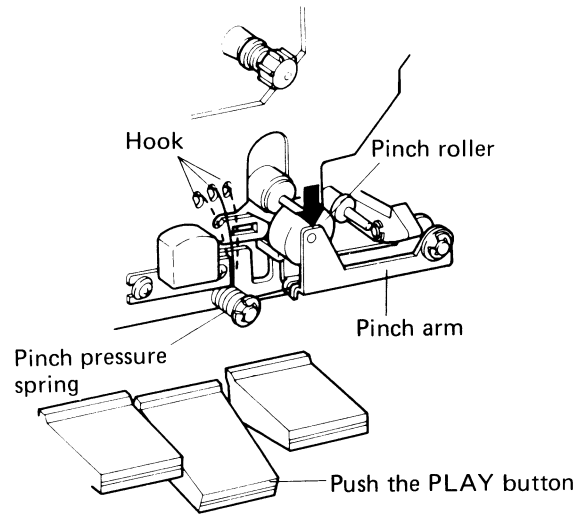


Fig. 34

9.3 TAPE SPEED

Adjustment Standard

Playback tape speed, wow/flutter test tape STD-301 and adjust for a frequency deviation of with 3000Hz +0.333% (3010Hz) −0.167% (2995Hz) at the position at which winding of the tape begins.

Adjustment Procedure (Fig. 35)

1. Insert a screwdriver into the hole at the rear of the motor and adjust the semifixed resistor.
2. When the semifixed resistor is turned clockwise, the speed increases and when it is turned counterclockwise, the speed decreases.

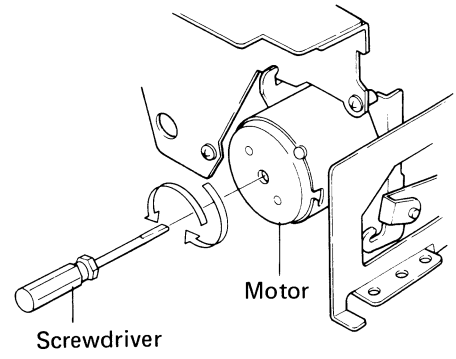


Fig. 35

9.4 MOTOR SWITCH AND PLAY TIMING

Adjustment Standard

The reel base and pinch roller (capstan) must start to rotate simultaneously or the reel base must start to rotate just before the pinch roller when the PLAY button has been pushed slowly. Moreover, when the reel base starts to rotate before the pinch roller, the clearance between the capstan and pinch roller the instant the reel base begins to rotate must be within 0—0.2mm.

Adjustment Procedure

1. Adjust by inserting a screwdriver into the groove of the switch bracket shown in Fig. 36 and moving the bracket to the front and rear so that the motor switch is turned on the instant the pinch roller is pushed against the capstan.

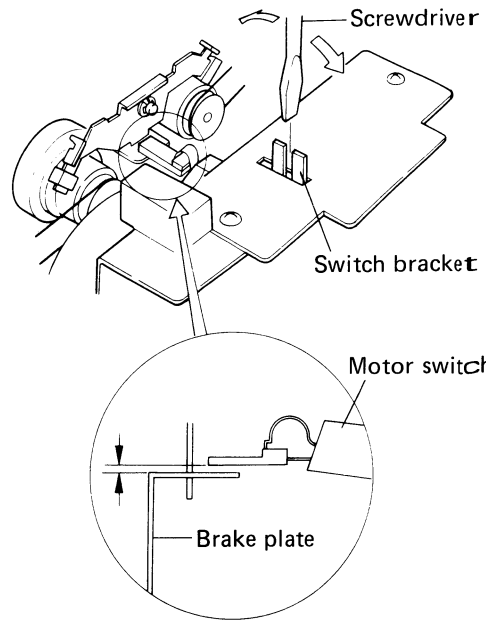


Fig. 36

2. If the precise adjustment mentioned above is not possible, then when the clearance between the pinch roller and capstan is within 0—0.5mm adjust switch bracket as described in item 1 above.
3. After adjusting item 2 above, adjust the clearance between the pinch roller and capstan to within 0—0.2mm by inserting a screwdriver at the contact point with the pinch arm of the head base (Fig. 37).
   In this case, be careful that the pinch roller is not damaged by the screwdriver.

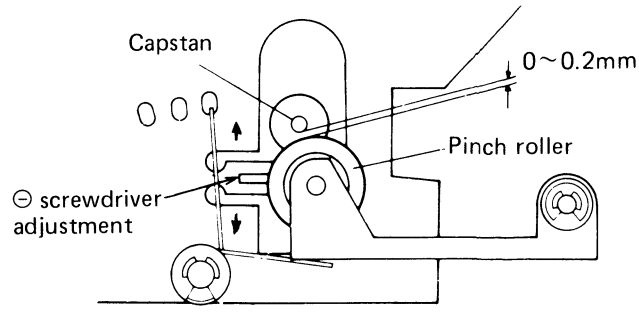


Fig. 37

Checks after Adjustment

1. Motor switch operation

There must be a front-rear stroke which switches the motor switch as illustrated.

When the PLAY, FF or REW button has been slowly pushed. Moreover, there must also be a front-rear stroke which switches the motor switch as illustrated. When the PLAY or FF button has been slowly returned by pushing the STOP button.

2. After motor switch operation

Load a tape and check if the tape bunches up and flys out or the set is placed into the fast forward state when the PLAY button is pushed normally (normal PLAY operation).

9.5 PAUSE TIMING ADJUSTMENT (Fig. 38)

Adjustment Standard

Separate the pinch roller from the capstan about 1—2mm by slowly pushing the PAUSE button in the PLAY state. Next, adjust so that the take-up reel shaft and pinch roller begin to rotate simultaneously when the PAUSE button has been slowly returned.

However, the take-up reel may begin to rotate first when the clearance between the pinch roller and capstan is within 0.1mm.

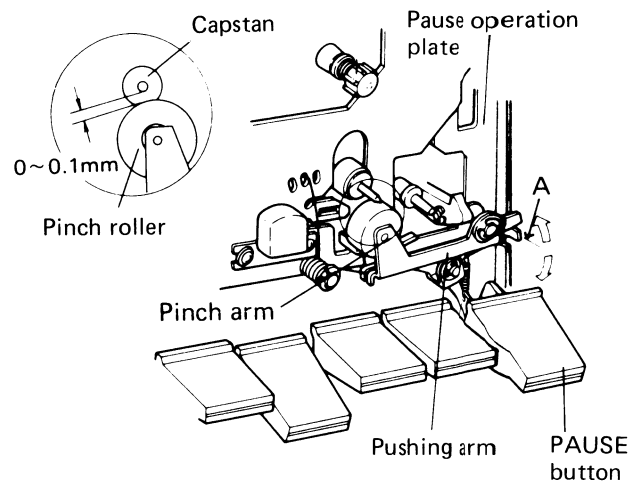


Fig. 38

Adjustment Procedure

Perform this adjustment after the motor switch and PLAY timing adjustment in par. 9.4.

Adjust the timing by bending the part indicated by A in Fig. 38 in the direction of movement of the pause operation plate.

The pinch arm and pause arm must be separated in the PLAY state (PAUSE OFF) after adjustment. Moreover, the tape must not fly out nor be set to the fast forward state when a tape is loaded, the set is placed into the PLAY state and the PAUSE button is operated.

9.6 MUTING SWITCH OPERATION

Adjustment Standard

The muting switch switching operation must be terminated and contact B must be moved $1(^{+0.5}_{-0.3})$ mm after switch separator contact A contacts fixed contact B when the set has been placed into the PLAY state (Fig. 39).

However, this movement does not include the movement due to button overstroke.

The switching timing must be as slow as possible at STOP → PLAY and as fast as possible at PLAY → STOP.

Adjustment Procedure

1. Insert the specified wiring connector (Fig. 40) into the connector printed circuit board.
2. Mount the cassette tape, insert a screwdriver at the groove shown in Fig. 39 and adjust the position so that the cassette lamp lights simultaneously with stopping of the head base when the PLAY button is slowly pushed.
3. Confirm that the cassette lamp is not extinguished by pushing the PLAY button upward when the PLAY button has been pushed and a tape has been played.

NOTE:
Fabricate an adjustment connector as shown in Fig. 40, using multisocket part No. RKP-004.

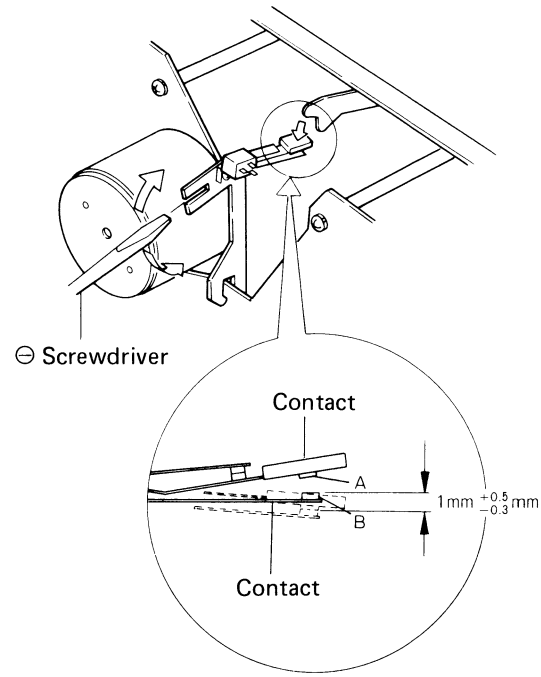


Fig. 39

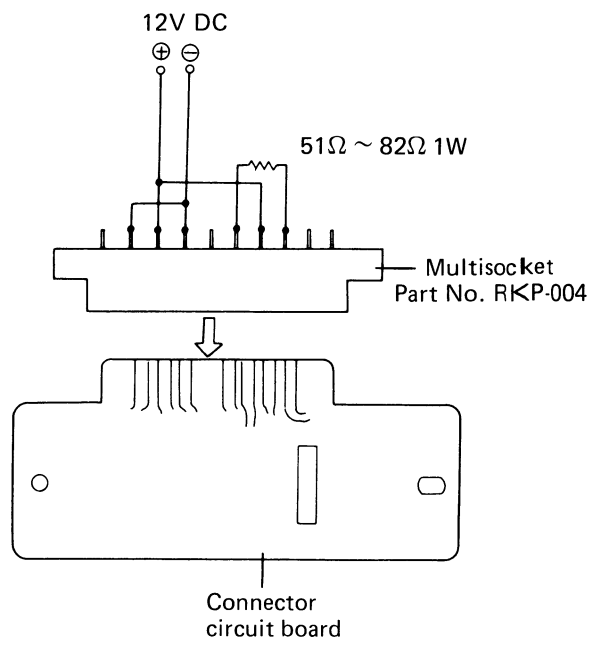


Fig. 40

10. ALIGNMENT OF REC/PB CIRCUITS

ADJUSTMENT ORDER

- **Playback**

10.1 Head angle adjustment
10.2 Playback level adjustment
(Note that playback level will change slightly when the playback equalizer is adjusted)
10.3 Playback equalizer adjustment

- **Record**

10.4 Level meter adjustment
10.5 Rough adjustment of recording current
10.6 Rough adjustment of recording bias
10.7 Recording/playback frequency response adjustment
10.8 Recording level adjustment
10.9 Dolby circuit adjustment

NOTES:

1. Clean the heads thoroughly before commencing adjustments.
2. Check that all mechanical adjustments have been completed prior to commencing electrical adjustments.
3. Test tapes to be used are:
   STD-341
   STD-601 ..... STD blank tape
   STD-602 ..... CrO_2 blank tape
   (STD-331)..... Playback frequency-response check tape
4. In section 10.7, adjustment of frequency response is effected by fine adjustment of the recording bias.
   Note that the REC amplifier peaking coil must not be touched by hand.
5. The reference recording level for the CT-606 is 160pwb/mm (at 333Hz), which is 4dB lower than 333Hz, 0dB (250pwb/mm) of STD-341.
6. Unless otherwise specified, "recording mode" referred to in the text assumes that a cassette half without chrome-tape detector holes has been loaded, and that the REC and PLAY buttons have been depressed. (The PAUSE button too may also have been depressed).
7. The DOLBY NR switch will also be in the OFF position unless otherwise specified.

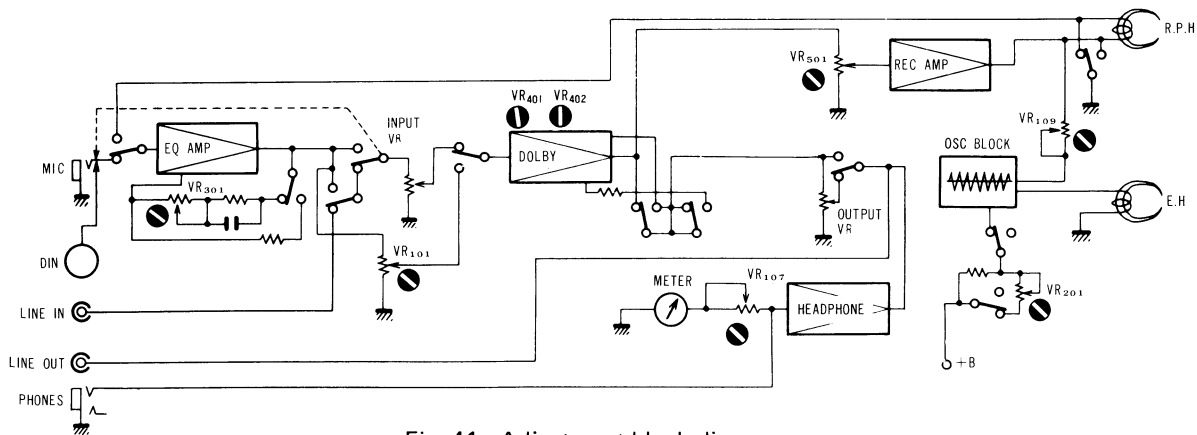


Fig. 41 Adjustment block diagram

SEMI-FIXED RESISTORS FOR ADJUSTMENTS

- **VR_{101} and VR_{102} (playback level adjustments)**

Included in the EQ amplifier output stage during playback mode, and used in adjusting the gain of the playback circuit, and balance between left and right channels.

- **VR_{301} and VR_{302} (playback equalizer adjustments)**

Inserted in the EQ amplifier NFB circuit, and used to achieve a flat playback frequency response by changing the circuit's time constants.

- **VR_{401} and VR_{402} (Dolby circuit adjustment)**
- **VR_{501} (recording level adjustments)**

Inserted in the REC amplifier input stage, and employed in establishing the reference recording level by adjusting the gain of the recording circuit.

- **VR_{109} and VR_{110} (recording bias adjustments)**

Inserted between the oscillator circuit and recording head, and used to adjust optimum recording bias current.

- **VR_{201} (CrO_2 recording bias adjustments)**

Used to adjust bias current and chrome-tape recording frequency response by changing the voltage of the oscillator circuit (when CrO_2 tape is loaded).

10.1 HEAD ANGLE ADJUSTMENT

1. Connect a millivoltmeter to the LINE OUT terminals (Fig. 42).
2. Set the tape selector switch to the STD position.
3. Play the 10kHz, −20dB section of the STD-341 test tape, and turn the head angle adjustment screw (Fig. 43) to obtain maximum output from both left and right channels.
4. Always lock the screw again after completing this adjustment. Use the screw tight green No. 300 (service part No. GYL-001).

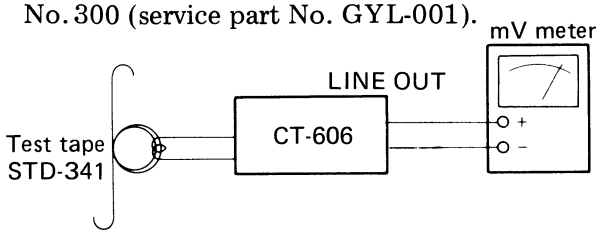


Fig. 42 Connection of head angle adjustment

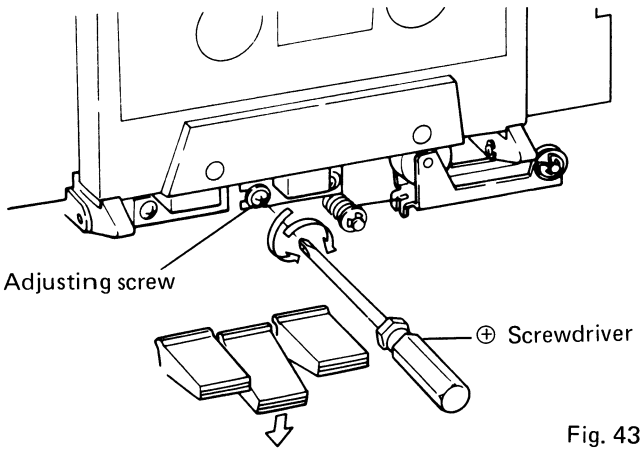


Fig. 43

10.2 PLAYBACK LEVEL ADJUSTMENT

1. Connect a millivoltmeter to the Dolby assembly test point (TP) terminals.
2. Set the tape selector switch to the STD position.
3. Turn the DOLBY NR switch on.
4. Set VR_{301} and VR_{302} to their mechanically central points.
5. Play the 333Hz, 0dB section of the STD-341 test tape, and then adjust VR_{101} and VR_{102} so that the millivoltmeter reads +1dBv (1122mV).
6. Since this adjustment determines the Dolby level, be as accurate as possible.

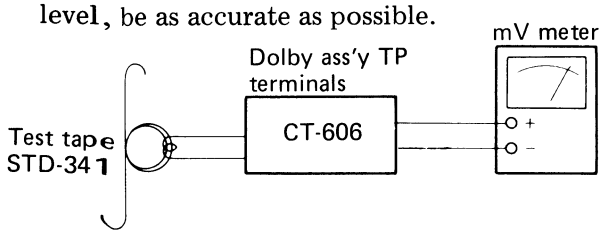


Fig. 44 Connection of playback level adjustment

10.3 PLAYBACK EQUALIZER ADJUSTMENT

1. Connect a millivoltmeter to the LINE OUT terminals.
2. Set the tape selector switch to the STD position.
3. Play the 333Hz, −20dB section of the STD-341 test tape, and read the value shown by the millivoltmeter.
4. Then play the 6.3kHz, −20dB section of this test tape, and adjust VR_{301} and VR_{302} so that the millivoltmeter reading is 0.5dB higher than the previous reading (at 333Hz).
5. Without making any other change, set the tape selector switch to the FeCr position, and check that the frequency response at 6.3kHz is −3 to −6dB lower than the reference level at 333Hz.

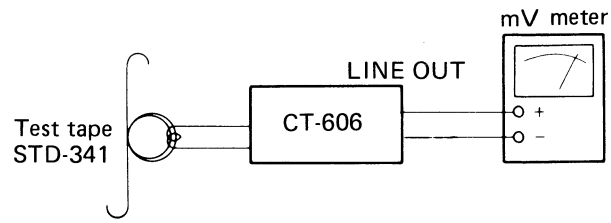


Fig. 45 Connection of playback equalizer adjustment

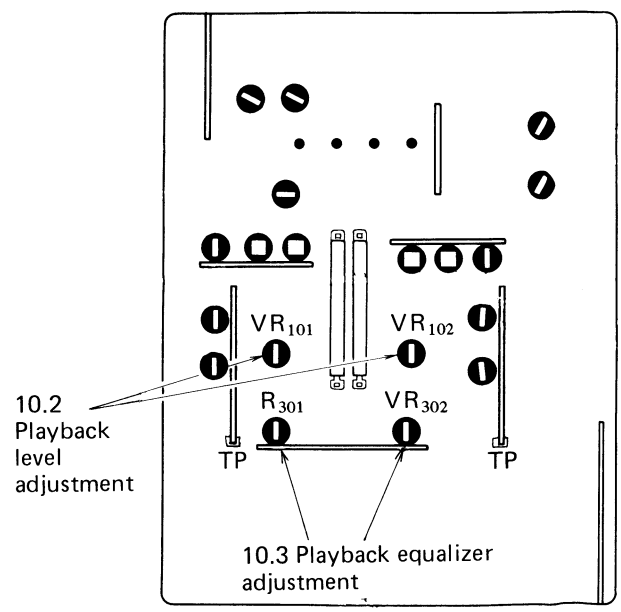


Fig. 46 Mother assembly adjustment places

Playback Frequency Response Check (Reference)

Play the STD-331 test tape, and check that the frequency response conforms to that shown in Fig. 47).

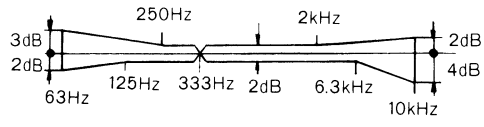


Fig. 47

10.4 LEVEL METER ADJUSTMENT

1. Connect a millivoltmeter to the Dolby assembly test point (TP) terminals (Fig. 48).
2. Depress the REC button only.
   * In this condition, the amplifier is prepared for recording, but the bias oscillator circuit remains inactive.
3. Apply a 333Hz, −10dBv (316mV) signal to the LINE INPUT terminals.
4. Adjust the INPUT volume control so that the millivoltmeter reads −3dBv (708mV).
5. Then adjust VR_{107} and VR_{108} so that the level meters read "0" dB.

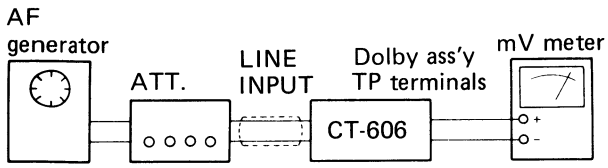


Fig. 48 Connection of level meter adjustment

10.5 ROUGH ADJUSTMENT OF RECORDING CURRENT

1. Fine adjustment of recording current is described as part of the "Recording Level Adjustment" in section 10.8.
2. Employ the same input signal and INPUT volume control setting as in Level Meter Adjustment" (section 10.4 above).
3. Connect millivoltmeter between terminals No. 20 (left) and No. 19 (ground), and between No. 22 (right) and No. 21 (ground) of the mother board assembly (Fig. 49).
4. Set the tape selector switch to the STD position.
5. Depress the REC button only, and adjust VR_{501} so that the millivoltmeter read 0.4mV.

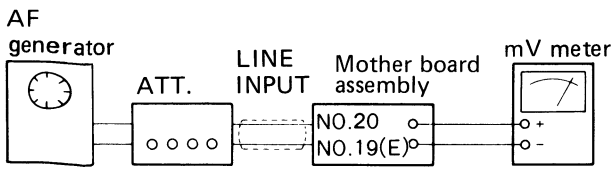


Fig. 49 Connection of rough adjustment of recording current

10.6 ROUGH ADJUSTMENT OF RECORDING BIAS

1. Fine adjustment of recording bias is described under section 10.7 "Recording/Playback Frequency Response Adjustment".
2. Connect millivoltmeter between terminals No. 20 (left) and No.19 (ground), and between No. 22 (right) and No. 21 (ground).
3. Set the tape selector switch to the STD position.
4. Turn the INPUT volume control down to minimum level, and put the deck into recording mode.
5. Adjust VR_{109} and VR_{110} so that the millivoltmeter read 5.0mV.

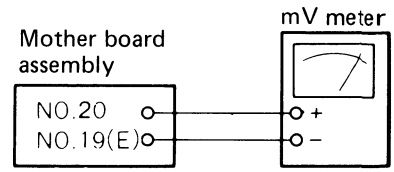


Fig. 50 Connection of rough adjustment of recording bias

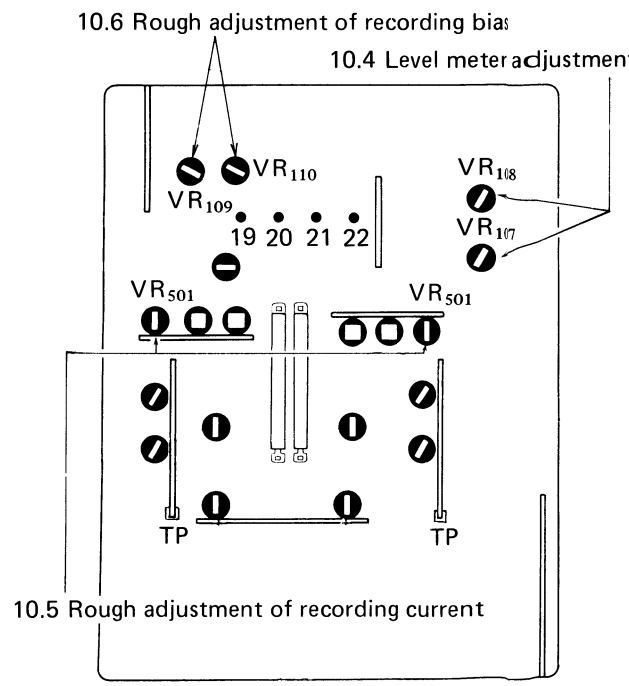


Fig. 51 Mother assembly adjustment places

10.7 RECORDING/PLAYBACK FREQUENCY RESPONSE ADJUSTMENT

1. Set the tape selector switch to the STD position.
2. Apply a 333Hz, −30dBv (31.6mV) signal to the INPUT terminals, and put the deck into recording mode.
3. Record the 333Hz and 6.3kHz signals onto the STD-601 test tape at −30dBv (31.6mV) input level (INPUT terminals).
4. Play back the signals recorded in step 3 above, and adjust VR_{109} and VR_{110} so that the millivoltmeter reads 0.5dB higher for the 6.3kHz signal than the 333Hz signal.
   - The change in frequency response due to readjustment of VR_{109} and VR_{110} will not be evident until recording and playback are repeated several times. Continue to repeat the recording/playback cycle until the 6.3kHz playback level is 0.5dB higher than the 333Hz level.
5. Check that the recording/playback frequency response in the 63Hz—12kHz range conforms to the limits shown in Figs. 57 and 58.
6. Now repeat the above procedure using the STD-602 test tape, adjusting VR_{201} until the 6.3kHz playback level is 0.5dB higher than the 333Hz level (allowable range −0.5 to +1.5dB).
7. Then recheck that the recording/playback frequency response again conforms to the limits shown in Figs 59 and 60.

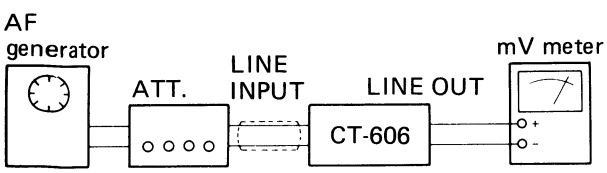


Fig 52 Connection of recording/playback frequency response adjustment

10.8 RECORDING LEVEL ADJUSTMENT

1. Connect a millivoltmeter to the Dolby assembly test point (TP) terminals.
2. Set the tape selector switch to the STD position.
3. Turn the DOLBY NR switch on.
4. Apply a 333Hz, −10dBv (316mV) signal to the INPUT terminals, and put the deck into recording mode.
5. Adjust the INPUT volume control so that the millivoltmeter reads −3dBv (708mV).
6. Record this signal onto the STD-601 test tape. During playback, adjust VR_{501} (left, right) so that the millivoltmeter reads −3dBv (708mV).
   - The change in playback level due to adjustment of VR_{501} will not be apparent until recording and playback are repeated several times. Continue to repeat the recording/playback cycle, and readjust until the −3dBv (708mV) level is obtained during playback.
7. Repeat the above procedure with the STD-602 test tape, and check that the playback level lies within the −3dBv ±1.5dB (596-841mV) range.

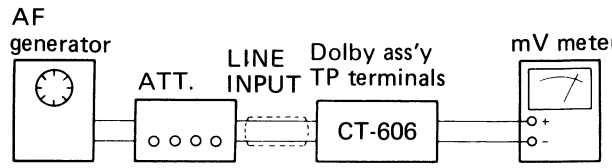


Fig. 53 Connection of recording level adjustment

10.7 Recording/playback frequency response adjustment

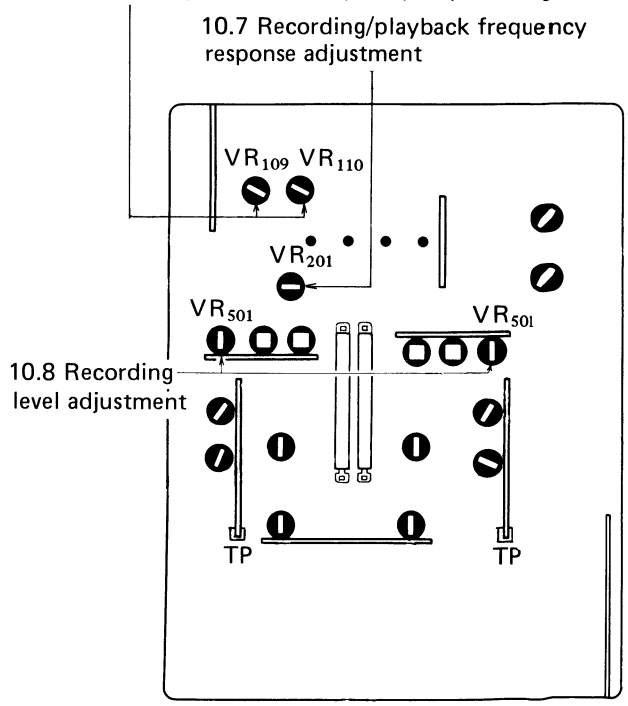


Fig. 54 Mother assembly adjustment places

10.9 DOLBY CIRCUIT ADJUSTMENT

- Connect the mV meter between TP terminal and E (ground) on the Dolby assembly.
- Turn the Dolby assembly VR_{401} maximum. Turn the DOLBY NR switch ON.
- Apply a −10dBv (316mV) 5kHz signal to the INPUT terminals and set to the recording state.

1. Adjust the INPUT level control so that the mV meter reads 1V.
2. Adjust the input signal level on the INPUT terminals to −50dBv (3.16mV), and adjust VR_{402} to give a reading of −30dBv (31.6mV) on the mV meter.
3. Alter the input signal level to the INPUT terminals to −40dBv (10mV), and adjust VR_{401} so that the mV meter reading is −22dBv (79.4mV).
4. The R ch also uses the Dolby assembly. Check and adjust this channel in accordance with items 1—3 above.

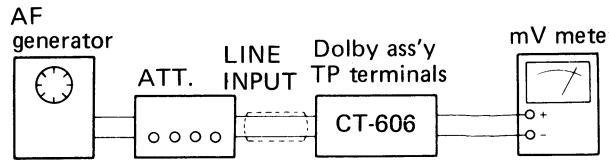


Fig. 55 Connection of Dolby circuit adjustment

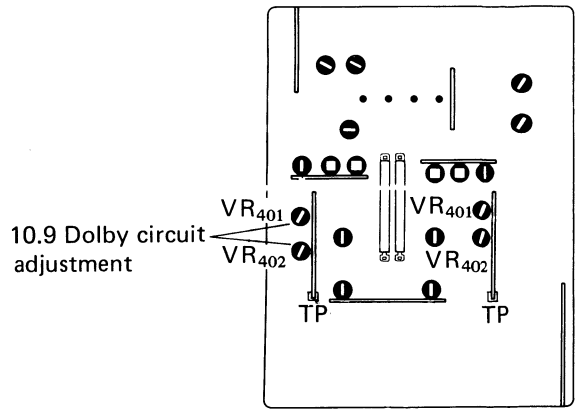


Fig. 56 Mother assemlby adjustment places

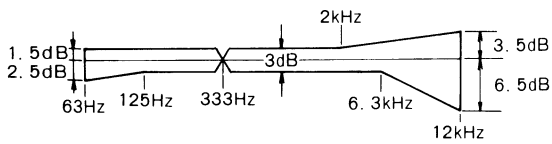


Fig. 57 Using STD-601 and the STD position, with DOLBY NR OFF.

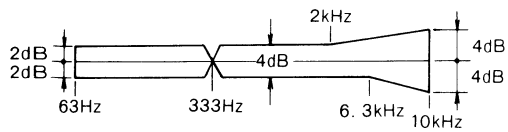


Fig. 58 Using STD-601 and the STD Position, with DOLBY NR ON.

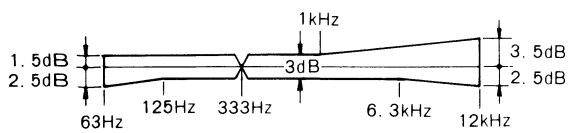


Fig. 59 Using STD-602 and the CrO_2 Position, with DOLBY NR OFF.

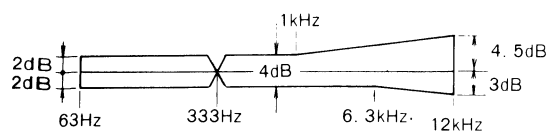


Fig. 60 Using STD-602 and the CrO_2 Position, with DOLBY NR ON.

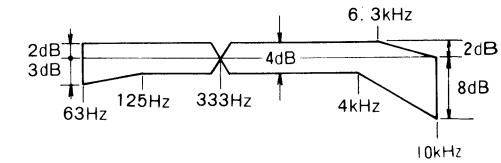


Fig. 61 Using STD-601 and the FeCr Position, with DOLBY NR OFF.

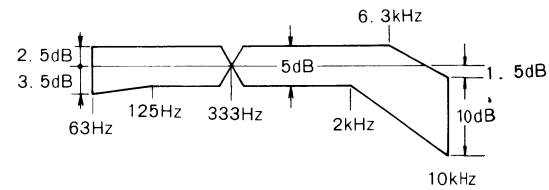


Fig. 62 Using STD-601 and the FeCr Position, with DOLBY ON.

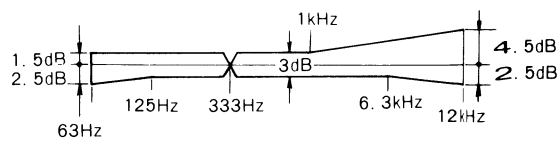


Fig. 63 Using SONY DUAD C-60 Suitable and the FeCr Position, with DOLBY NR OFF.

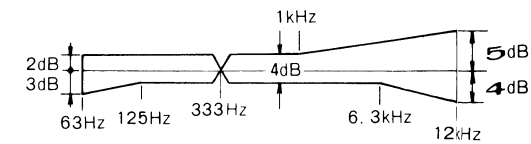
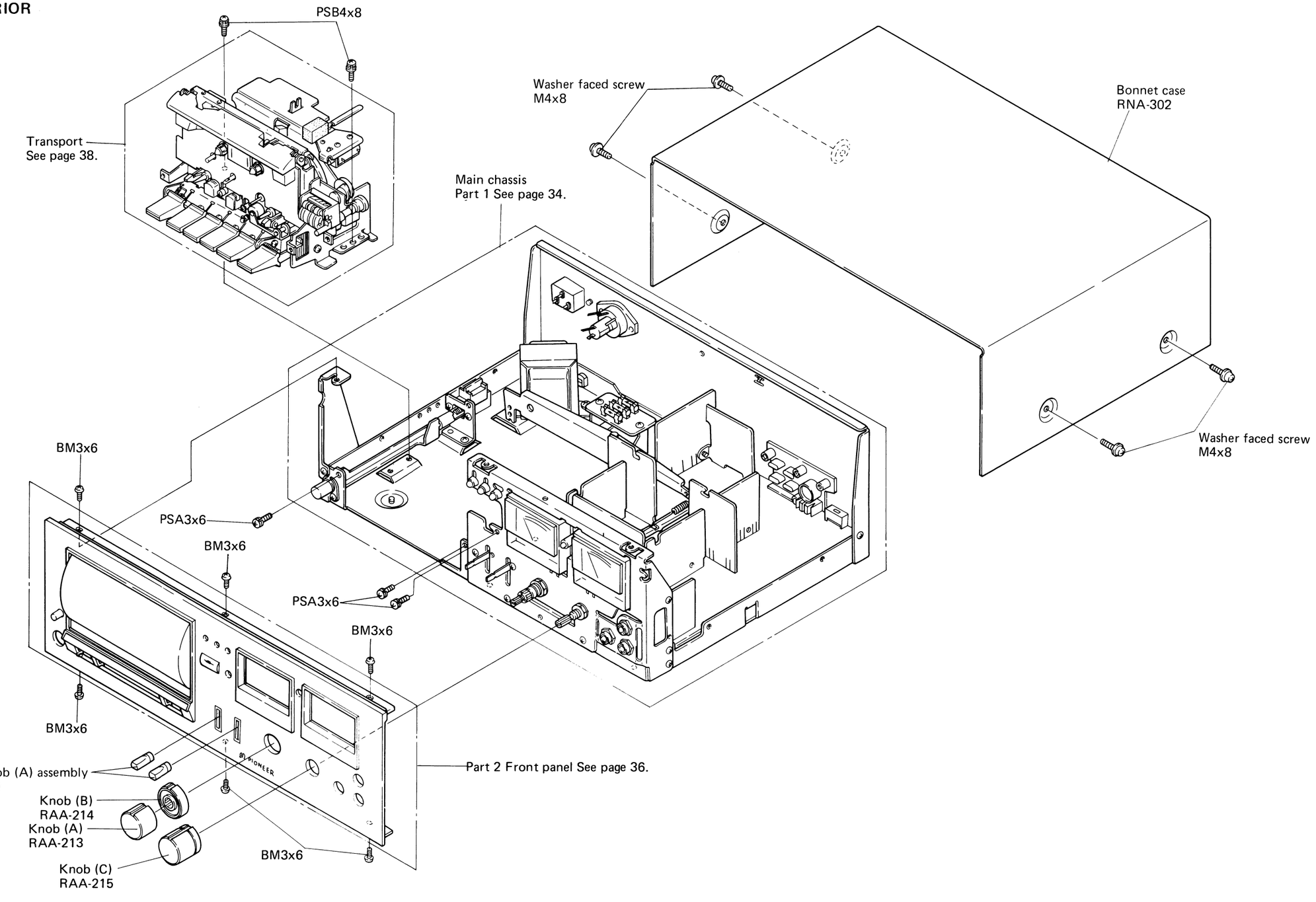


Fig. 64 Using SONY DUAD C-60 Suitable and the FeCr Position, with DOLBY NR ON.

11. EXPLODED VIEWS

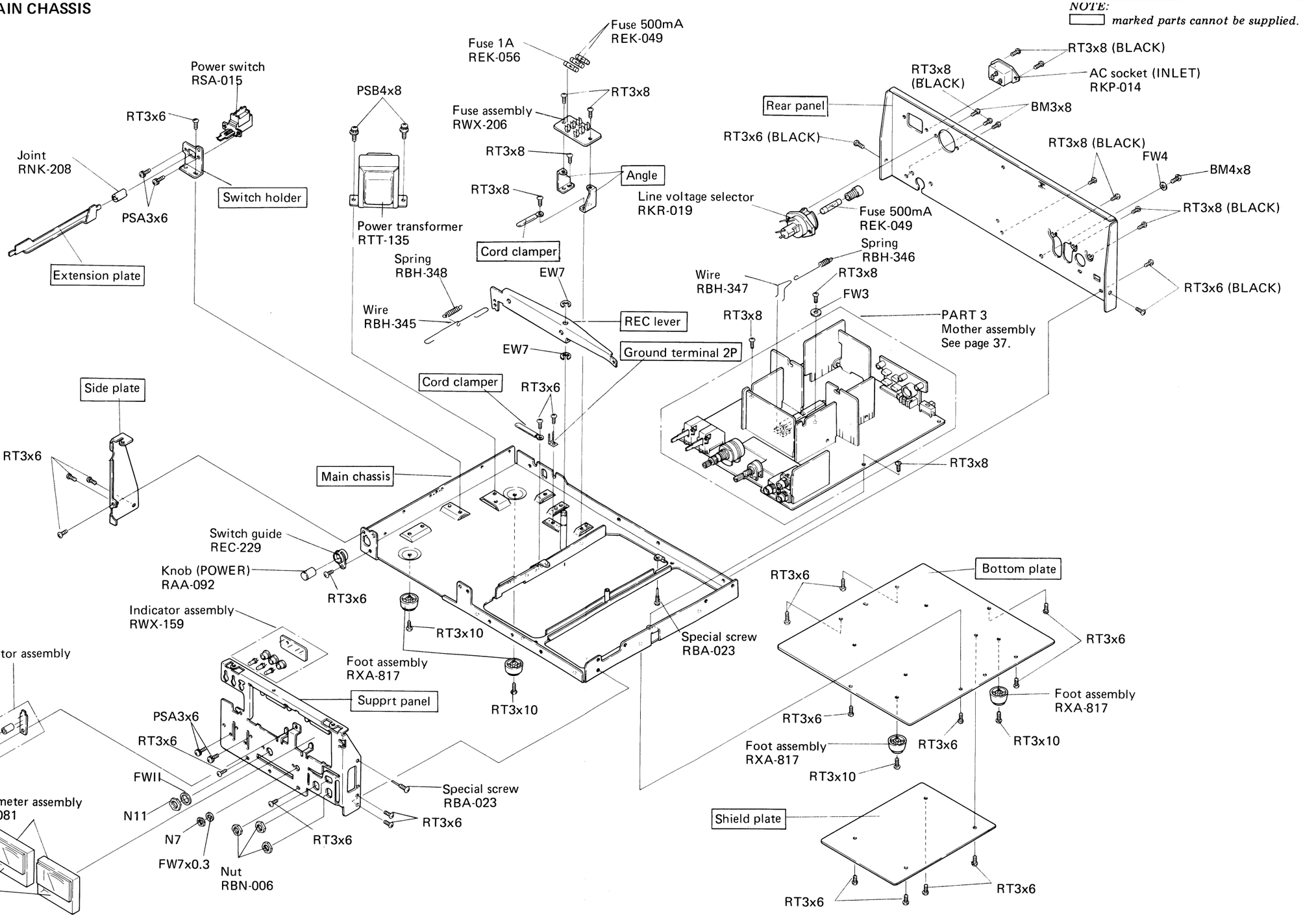
NOTE:
marked parts cannot be supplied.

11.1 EXTERIOR



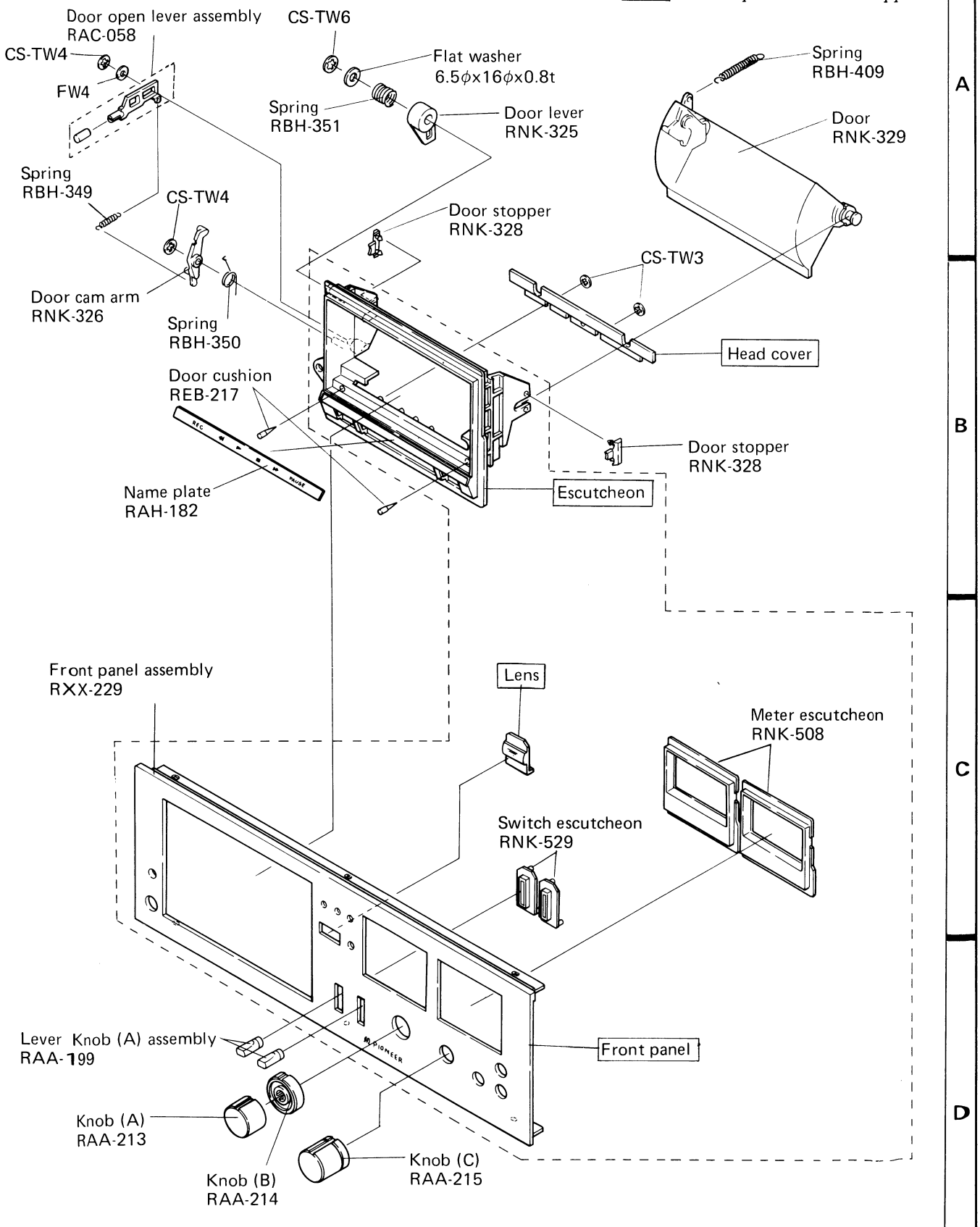
11.2 PART 1 MAIN CHASSIS

NOTE:
□ *marked parts cannot be supplied.*



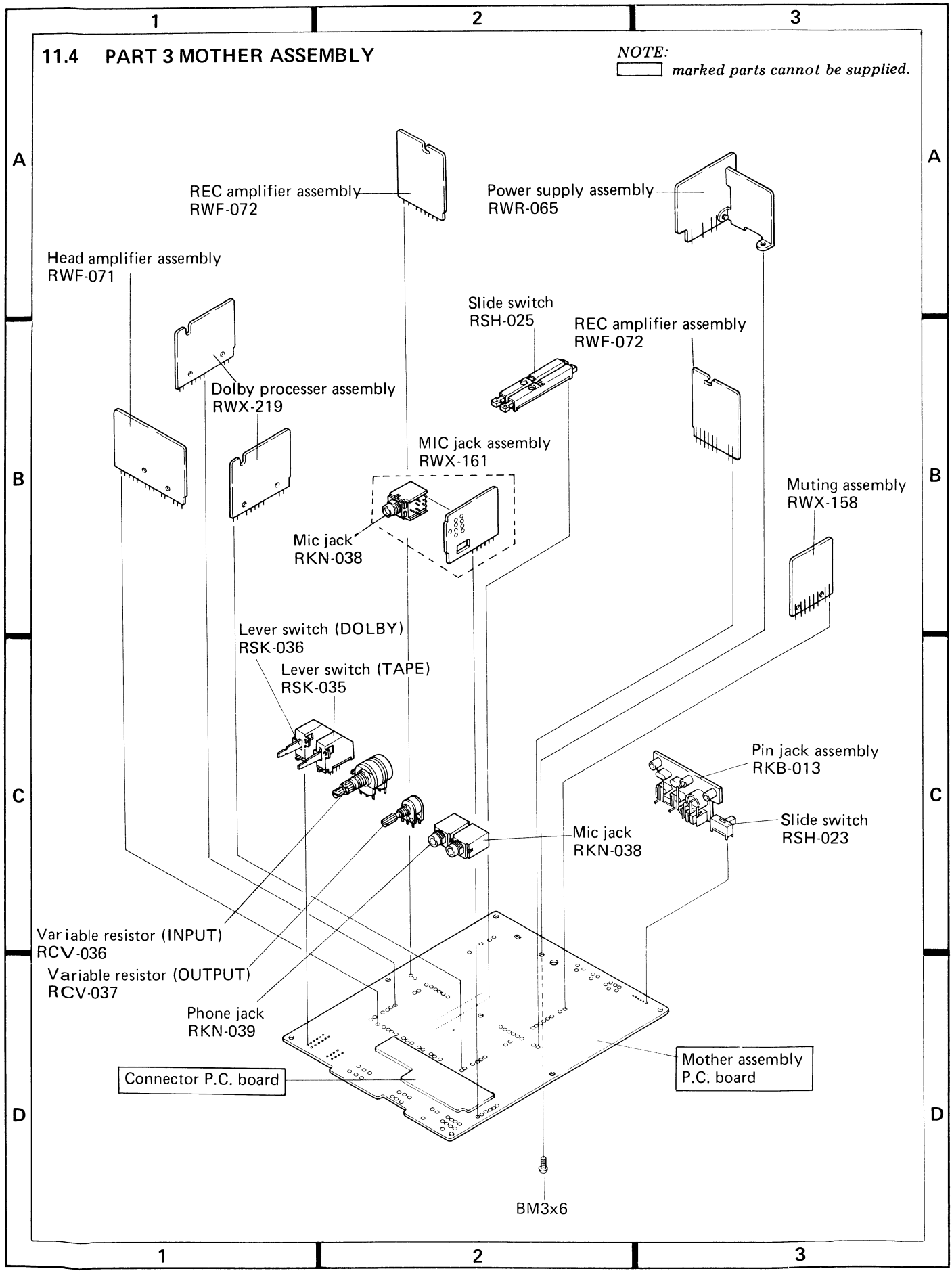
11.3 PART 2 FRONT PANEL

NOTE:
marked parts cannot be supplied.



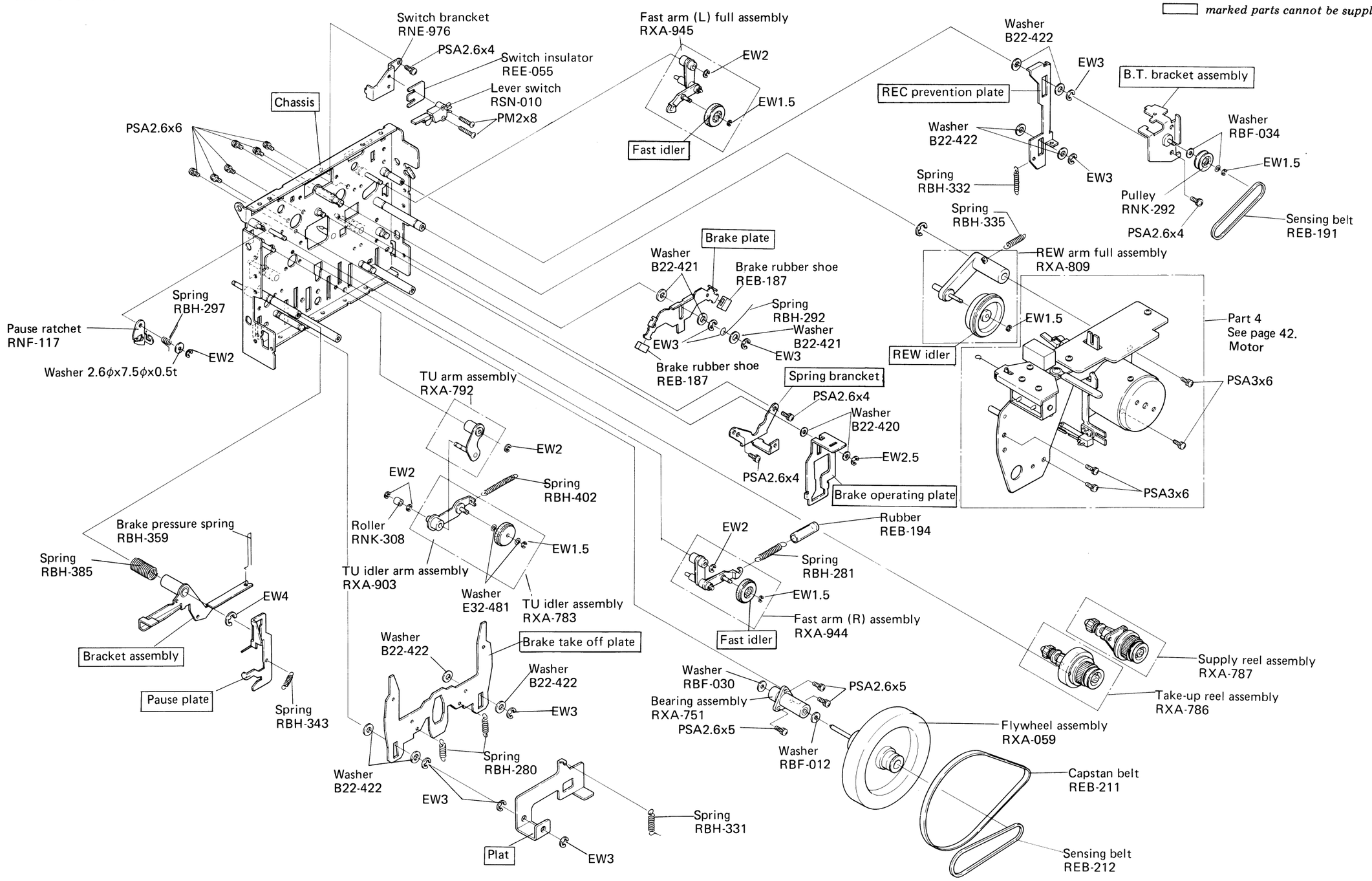
11.4 PART 3 MOTHER ASSEMBLY

NOTE:
□ *marked parts cannot be supplied.*



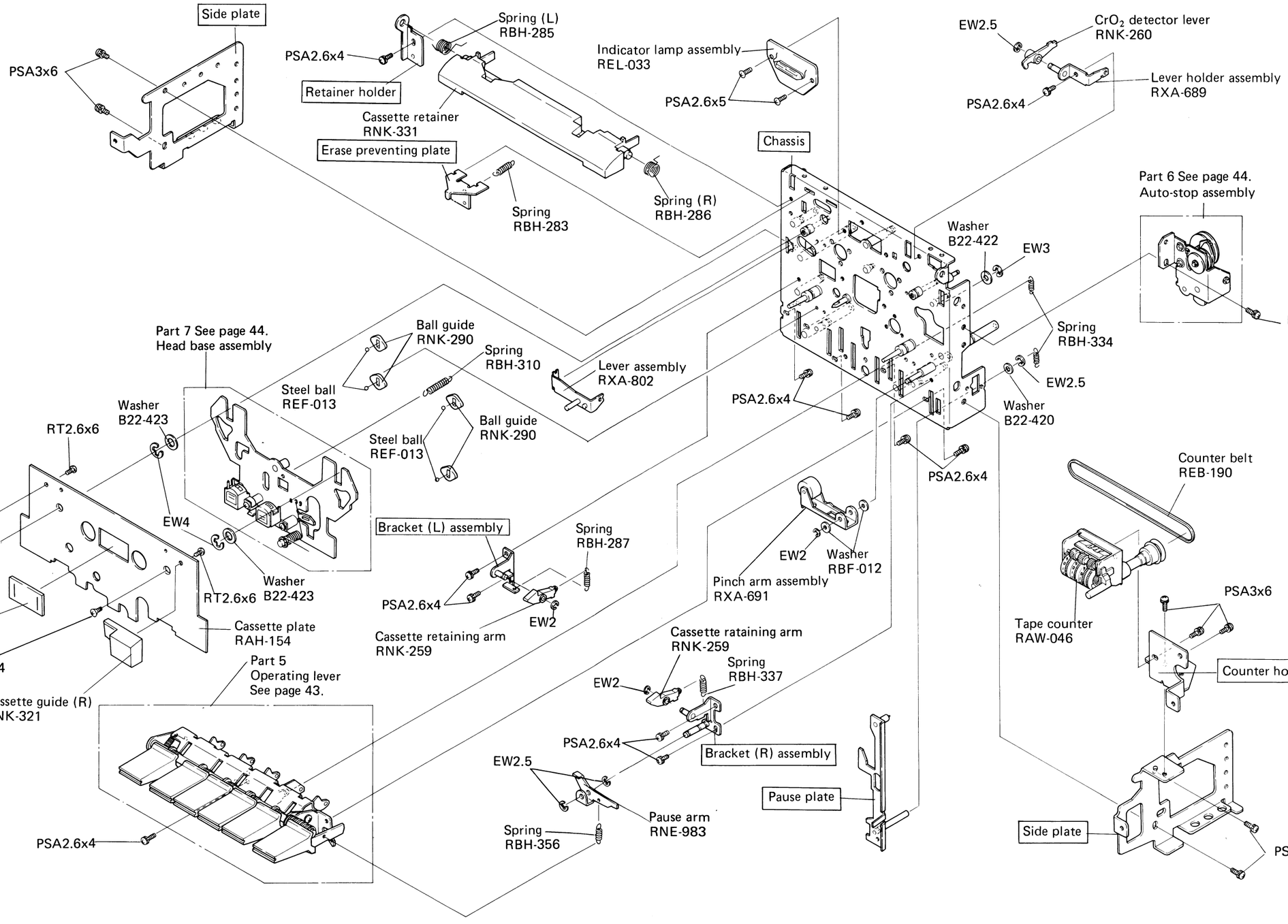
11.5 TRANSPORT 1

NOTE:
[ ] *marked parts cannot be supplied.*



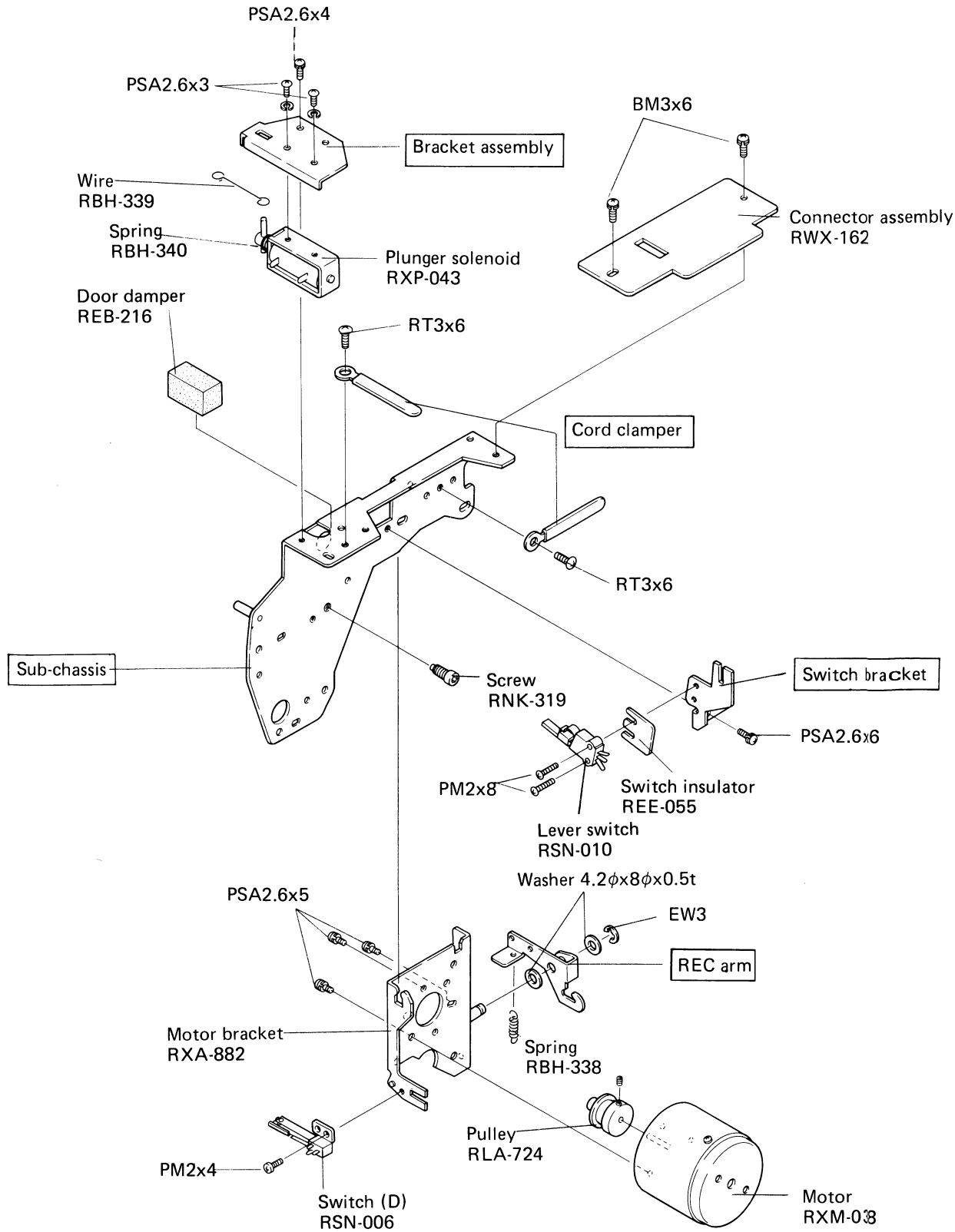
11.6 TRANSPORT 2

NOTE:
□ *marked parts cannot be supplied.*



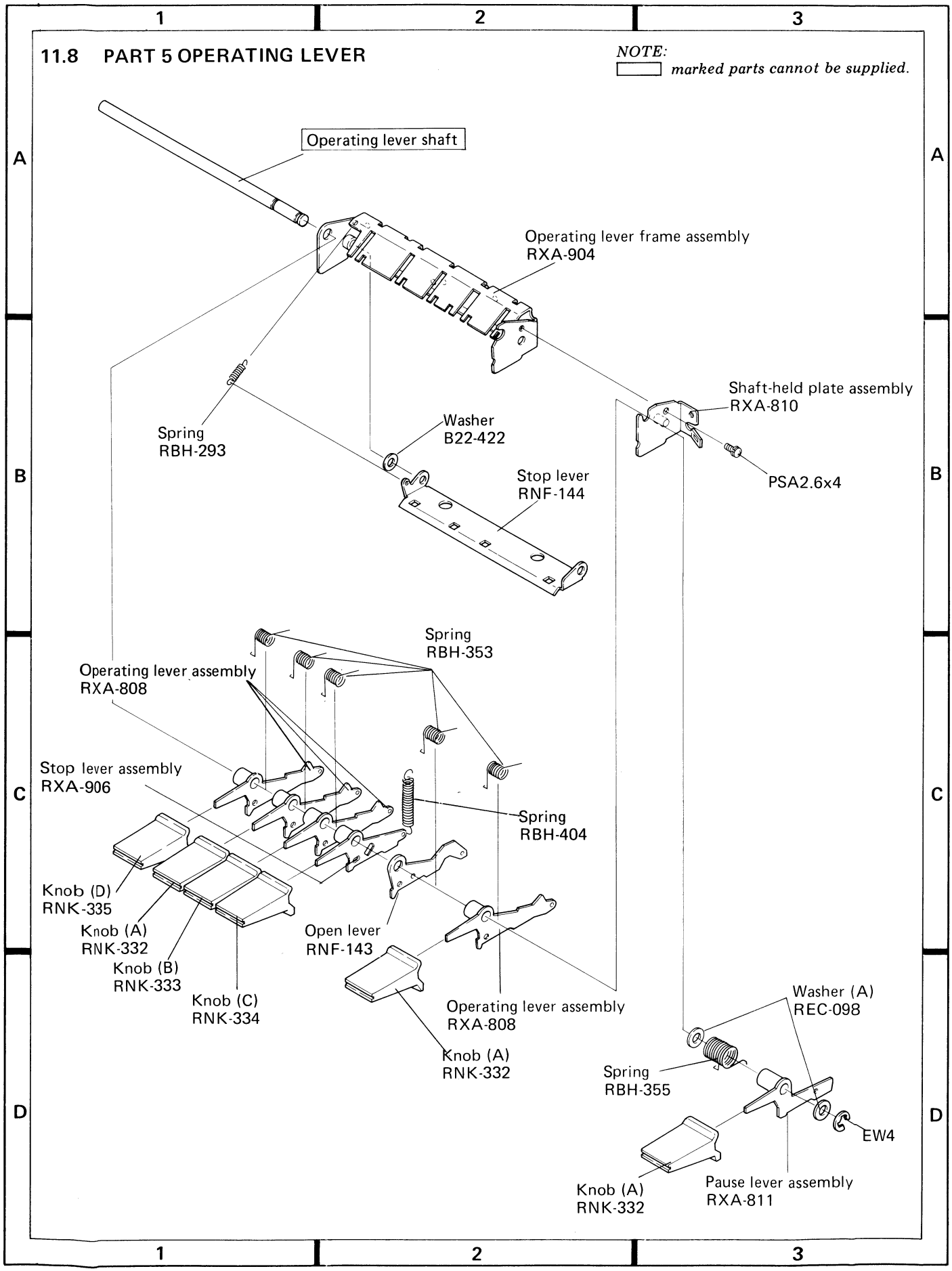
11.7 PART 4 MOTOR

NOTE:
marked parts cannot be supplied.



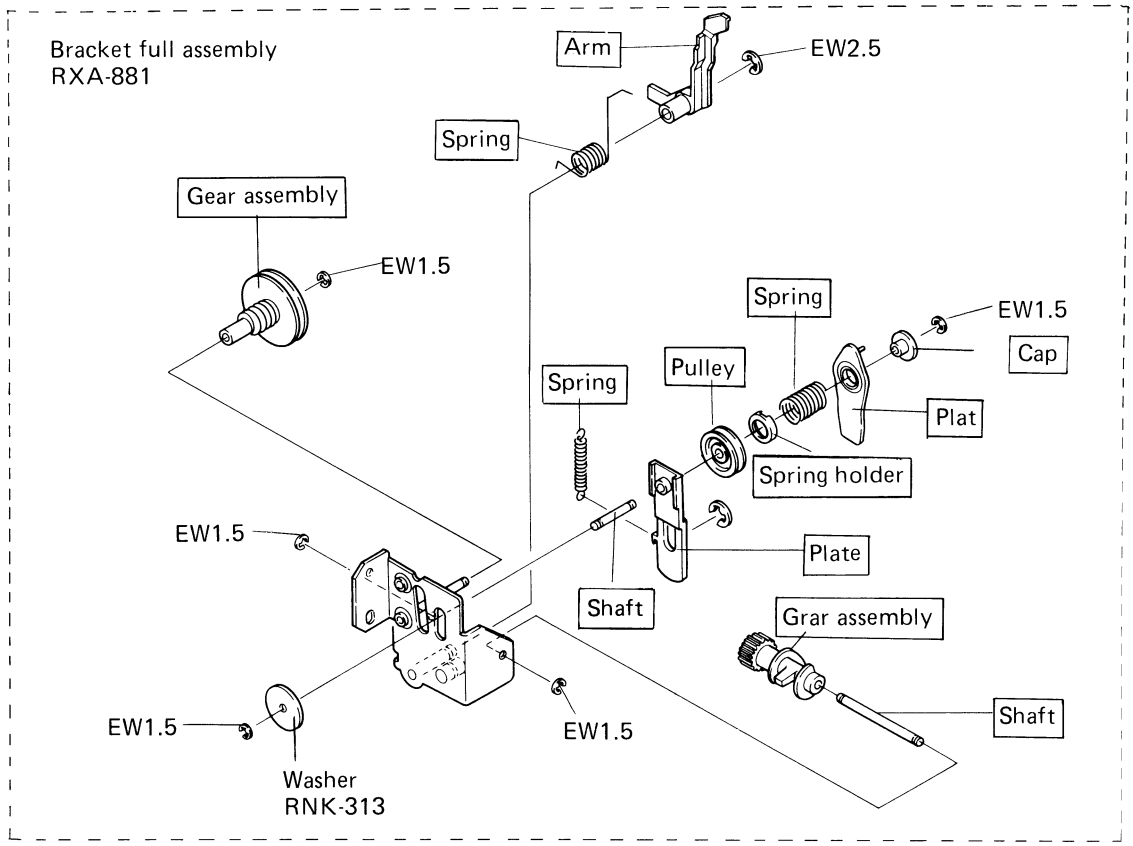
11.8 PART 5 OPERATING LEVER

NOTE:
□ *marked parts cannot be supplied.*

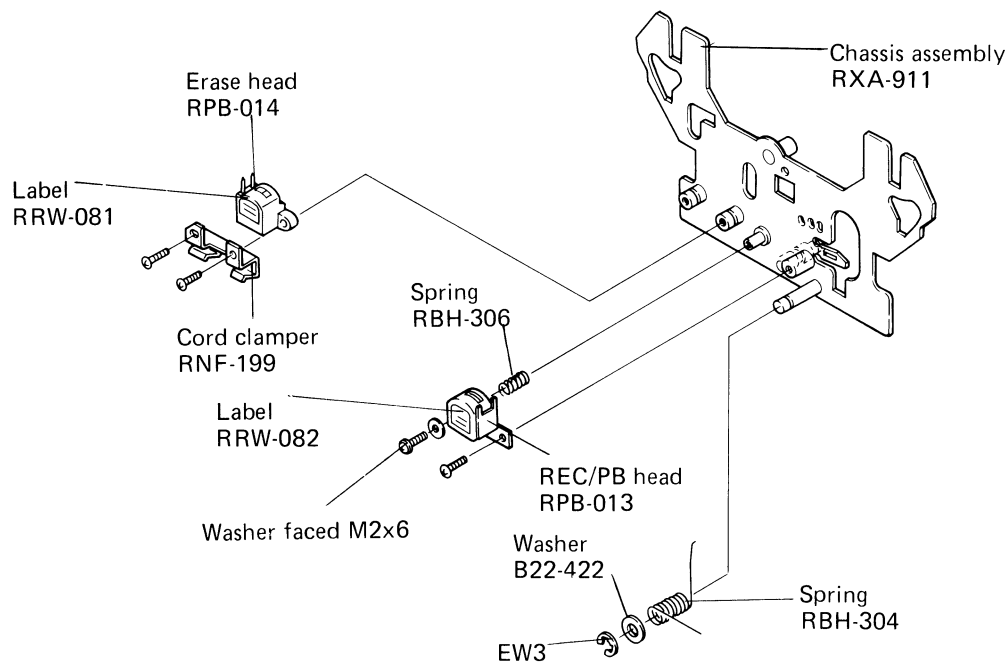


11.9 PART 6 AUTO-STOP ASSEMBLY

NOTE:
marked parts cannot be supplied.



11.10 PART 7 HEAD BASE ASSEMBLY



12. SCHEMATIC DIAGRAMS, P.C. BOARD PATTERNS AND PARTS LIST

12.1 MISCELLANEA

Mescellanea Parts

NOTE:
When ordering resistors, first covert resistance values into code form as shown in the following examples.

Ex. 1 When there are 2 effective digits (any digit apart from 0), such as 560 ohm and 47k ohm (tolerance is shown by J = 5%, and K = 10%).

560Ω	*56 x 10¹*	*561*	*RD¼PS* 5 6 1 *J*
47kΩ	*47 x 10³*	*473*	*RD¼PS* 4 7 3 *J*
0.5Ω	*0R5*		*RN2H* 0 R 5 *K*
1Ω	*010*		*RSIP* 0 1 0 *K*

Ex. 2 When there are 3 effective digits (such as in high precision metal film resistors).

5.62kΩ	*562 x 10¹*	*5621*.	*RN¼SR* 5 6 2 1 *F*

P.C. BOARD ASSEMBLIES

Part No.	Description
	Mother assembly
RWF-071	Head amplifier assembly
RWX-219	Dolby processer assembly
RWF-072	REC amplifier assembly
RWR-065	Power supply assembly
RWX-158	Muting assembly
RWX-161	Mic jack assembly
RWX-162	Connection assembly
RWX-160	REC indicator assembly
RWX-159	Indicator assembly
RWX-206	Fuse assembly

SWITCH

Part No.	Symbol & Description	
RSA-015	S1	Power switch (POWER)

CAPACITORS

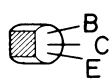
Part No.	Symbol & Description
CKDYF 473Z 50	C1, C2

OTHERS

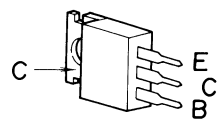
Part No.	Symbol & Description	
RTT-135	T1	Power transformer
RKP-014		AC socket (INLET)
RKR-019		Line voltage selector
REK-049		Fuse 500mA
REL-050		Meter lamp
RAW-081		Level meter assembly
RXM-038		Motor
RPB-013		REC/PB head
RPB-014		Erase head
RXP-043		Plunger solenoid
SIB0101	Diode	
(SIB0102)		
(W03C)		
(W03B)		

External Appearances of Transistors

2SC828
2SC1327
2SC1684
2SA564

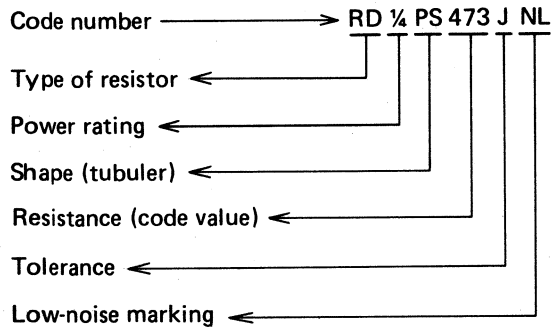


2SD234
2SC1419



RESISTANCE VALUE CODES

Code numbers of resistors used in Pioneer equipment are expressed in the following way:—



Furthermore, in the list of parts found in the Service Manual, the resistance (code value) part of the above code number is expressed as □□□ or □□□□.

Resistors included in the Service Manual list of parts

↓

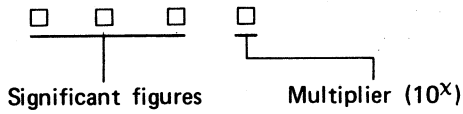
Ex. RD ¼ PS □□□ JNL

When ordering resistor components, first ascertain the actual resistance value from the circuit diagram, and then convert it into code no. form as shown in the following examples.

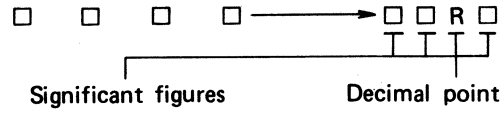
For further details on code numbers, refer to "Tuning Fork" VOL. 1.

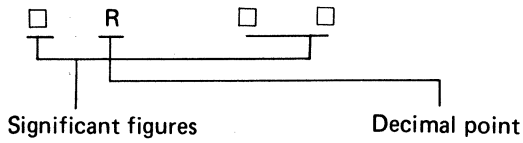
Ex. 1 For □□□□ Codes

* **General resistors**



* **Resistors with fractional values**



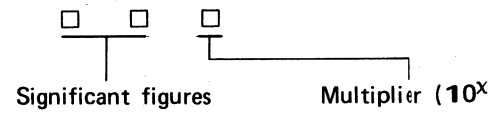


Ex. 1

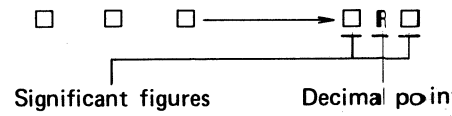
Nominal resistance (Ω)	Significant figure (three figures)	Multiplier (10X)	Resistance value code
5.1	510	.....	5R10
5.62	562	.....	5R62
10	100	.....	10R0
22.5	225	.....	22R5
110	110	x10⁰	1100
1k (1000)	100	x10¹	1001
1.56k (1560)	156	x10¹	1561
10k (10000)	100	x10²	1002
33.6k (33600)	336	x10²	3362
112k (112000)	112	x10³	1123
1M (1000000)	100	x10⁴	1004
1.56M (1560000)	156	x10⁴	1564

Ex. 2 For □□□ Codes

* **General resistors**



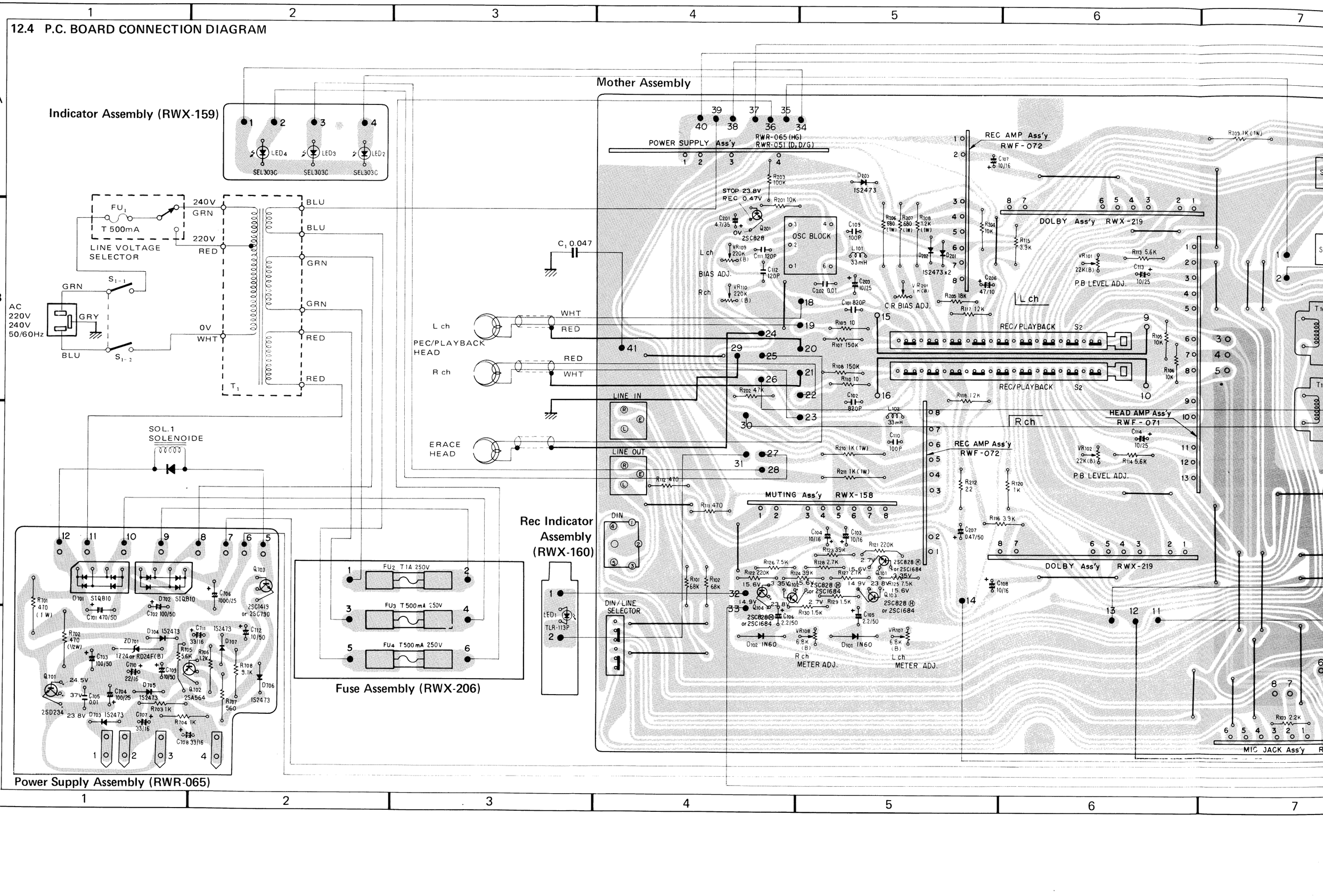
* **Resistors with fractional values**

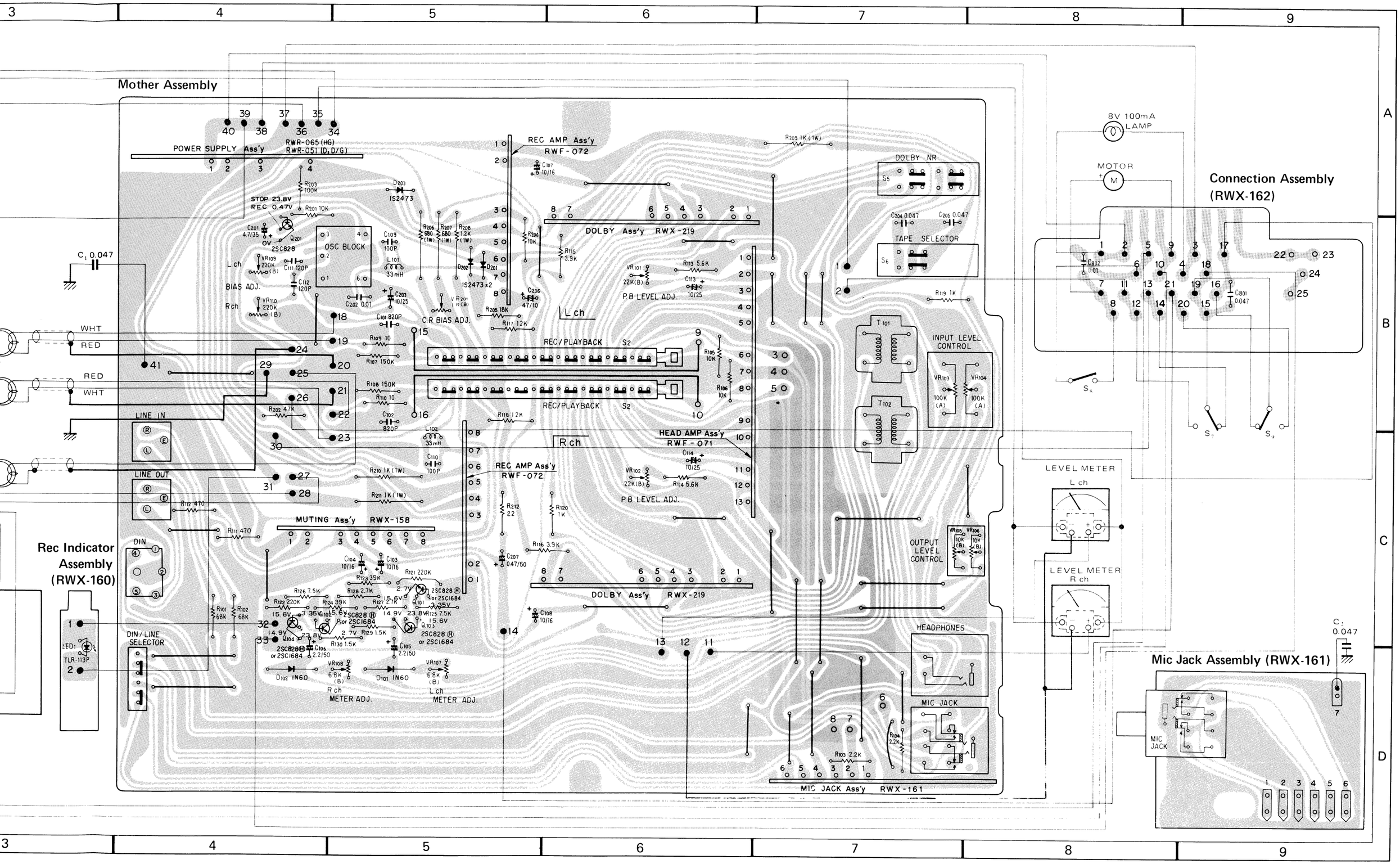


Ex. 2

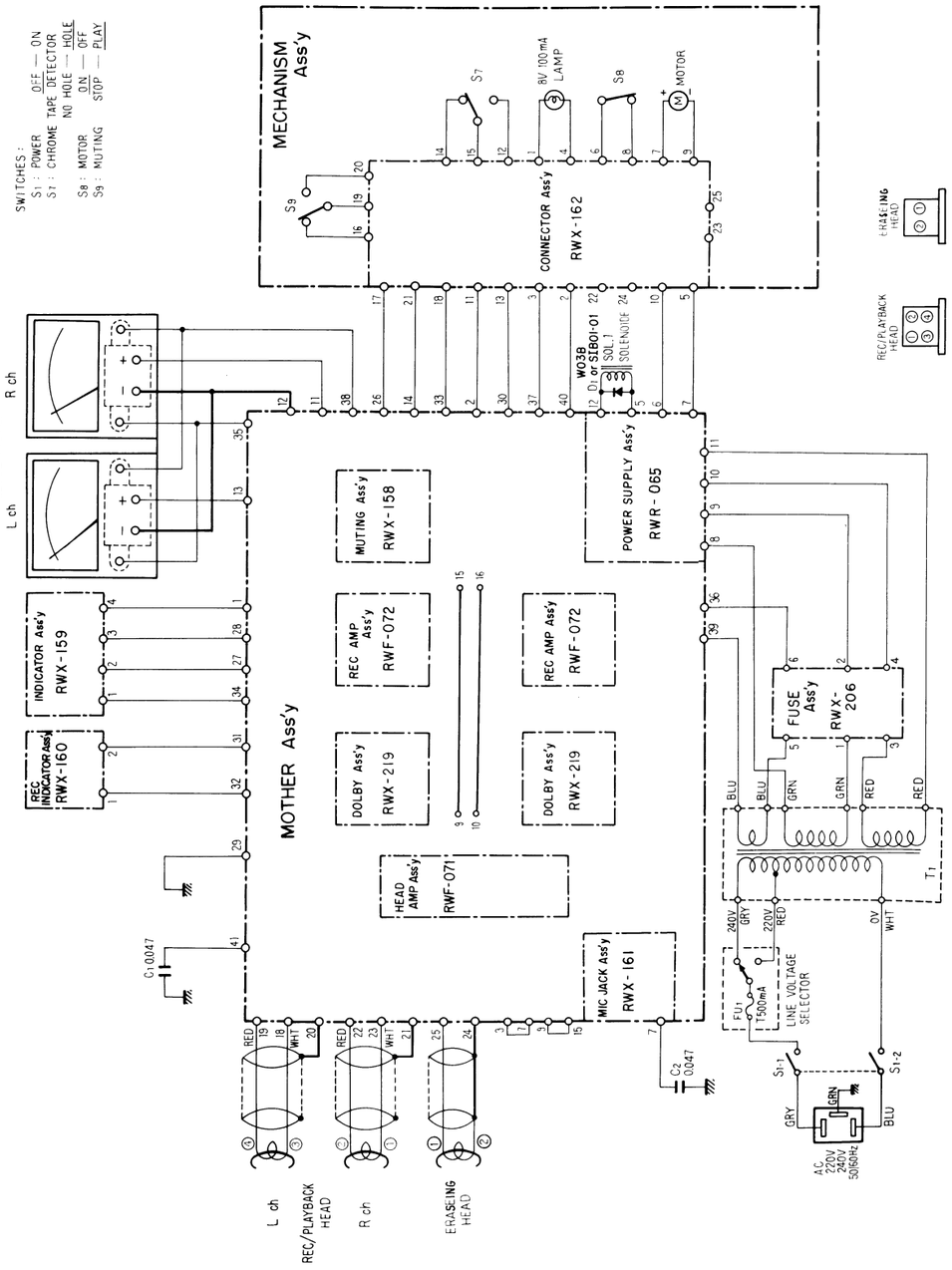
Nominal resistance (Ω)	Significant figure (two figures)	Multiplier (10X)	Resistance value code
0.5	05	.....	0R5
1.5	15	.....	1R5
1	01	x10⁰	010
22	22	x10⁰	220
330	33	x10¹	331
1k (1000)	10	x10²	102
5.6k (5600)	56	x10³	562
68k (68000)	68	x10³	683
820k (820000)	82	x10⁴	824
1M (1000000)	10	x10⁵	105
2.2M (2200000)	22	x10⁵	225

12.4 P.C. BOARD CONNECTION DIAGRAM

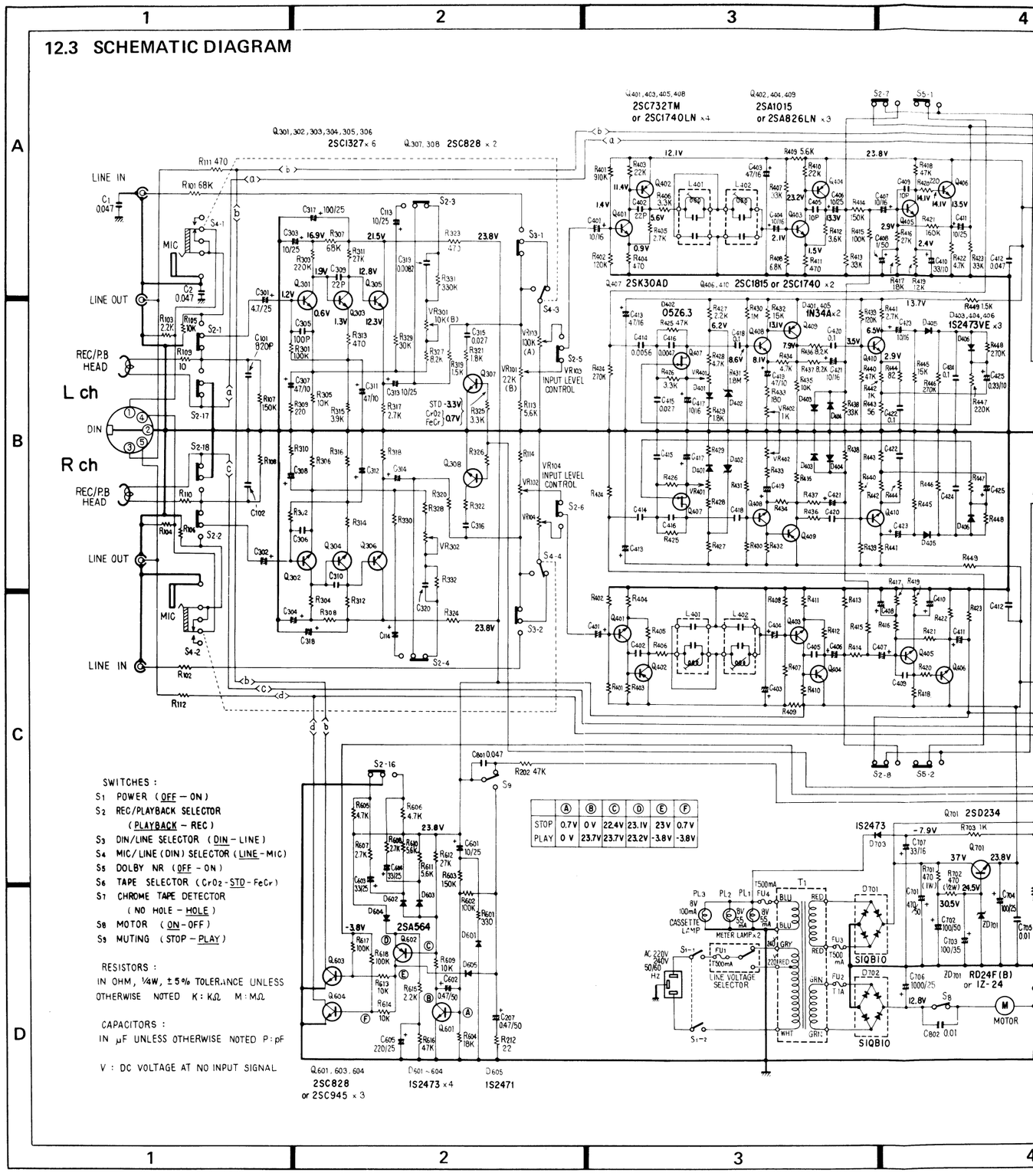



Mother Assembly
POWER SUPPLY Ass'y
RWR-065 (HG)
RWR-051 (D, D/G)
STOP 23.8V
REC 0.47V
OSC BLOCK
BIAS ADJ.
Lch
Rch
REC AMP Ass'y
RWF-072
DOLBY Ass'y RWX-219
REC/PLAYBACK S2
C.R BIAS ADJ.
P.B LEVEL ADJ.
HEAD AMP Ass'y
RWF-071
MUTING Ass'y RWX-158
DOLBY NR
TAPE SELECTOR
INPUT LEVEL CONTROL
OUTPUT LEVEL CONTROL
LINE IN
LINE OUT
DIN
DIN/LINE SELECTOR
R ch METER ADJ.
L ch METER ADJ.
HEADPHONES
MIC JACK
MIC JACK Ass'y RWX-161
8V 100mA LAMP
MOTOR
LEVEL METER L ch
LEVEL METER R ch
Connection Assembly (RWX-162)
Rec Indicator Assembly (RWX-160)
Mic Jack Assembly (RWX-161)
WHT
RED
RED
WHT

12.2 CIRCUIT OUTLINE

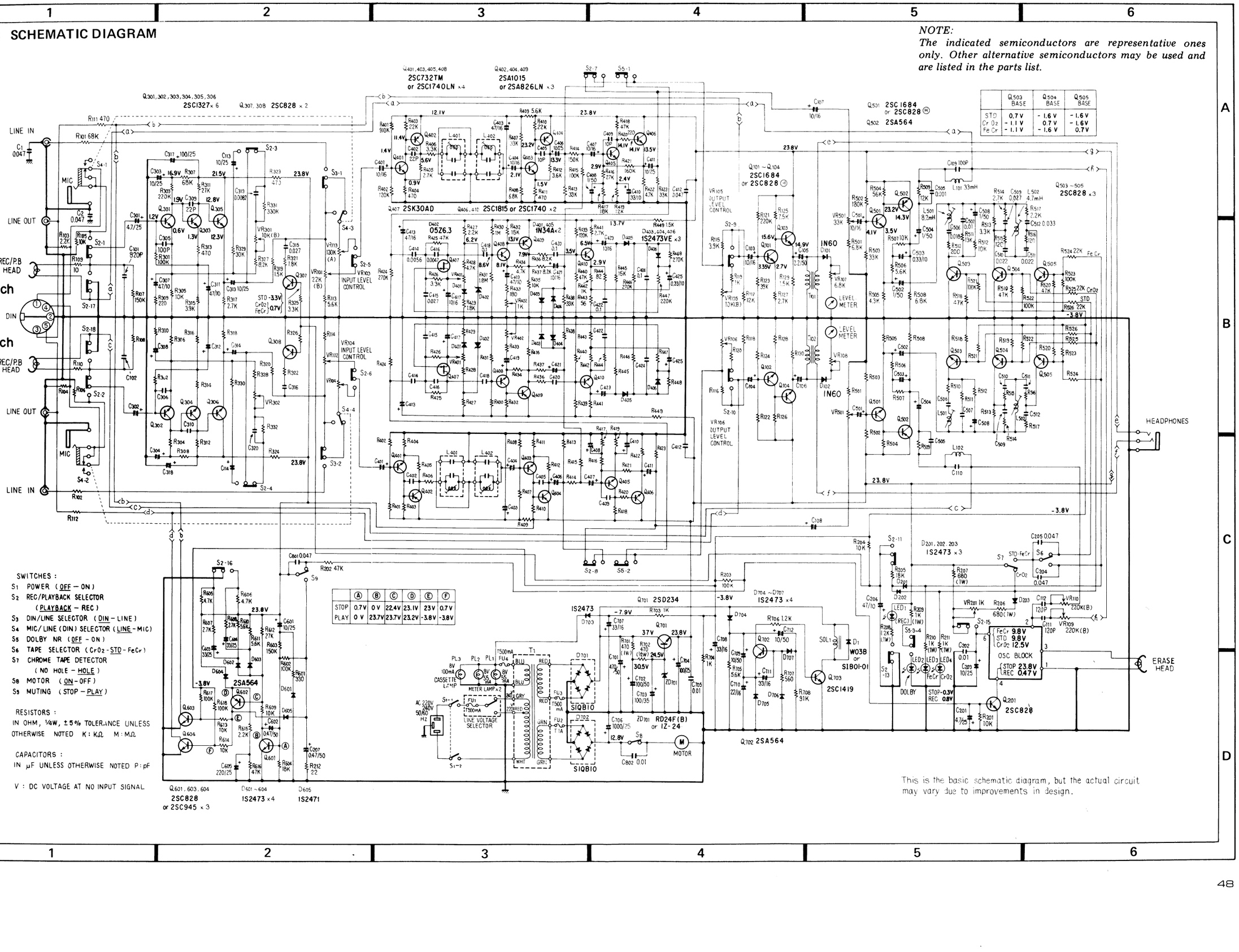


12.3 SCHEMATIC DIAGRAM


Q301, 302, 303, 304, 305, 306 2SC1327 × 6
Q307, 308 2SC828 × 2
Q401, 403, 405, 408 2SC732TM or 2SC1740LN × 4
Q402, 404, 409 2SA1015 or 2SA826LN × 3
Q407 2SK30AD
Q406, 410 2SC1815 or 2SC1740 × 2
LINE IN
LINE OUT
REC/PB HEAD
L ch
R ch
DIN
MIC
INPUT LEVEL CONTROL
SWITCHES :
S1 POWER (OFF — ON)
S2 REC/PLAYBACK SELECTOR (PLAYBACK — REC)
S3 DIN/LINE SELECTOR (DIN — LINE)
S4 MIC/LINE (DIN) SELECTOR (LINE — MIC)
S5 DOLBY NR (OFF — ON)
S6 TAPE SELECTOR (CrO2 - STD - FeCr)
S7 CHROME TAPE DETECTOR (NO HOLE — HOLE)
S8 MOTOR (ON — OFF)
S9 MUTING (STOP — PLAY)
RESISTORS :
IN OHM, ¼W, ±5% TOLERANCE UNLESS OTHERWISE NOTED K : KΩ M : MΩ
CAPACITORS :
IN μF UNLESS OTHERWISE NOTED P : pF
V : DC VOLTAGE AT NO INPUT SIGNAL
Q601, 603, 604 2SC828 or 2SC945 × 3
D601 ~ 604 1S2473 × 4
D605 1S2471
Q701 2SD234
1S2473
SIQB10
RD24F(B) or IZ-24
METER LAMP × 2
LINE VOLTAGE SELECTOR
MOTOR
STOP 0.7V 0V 22.4V 23.1V 23V 0.7V
PLAY 0V 23.7V 23.7V 23.2V -3.8V -3.8V

12.3 SCHEMATIC DIAGRAM

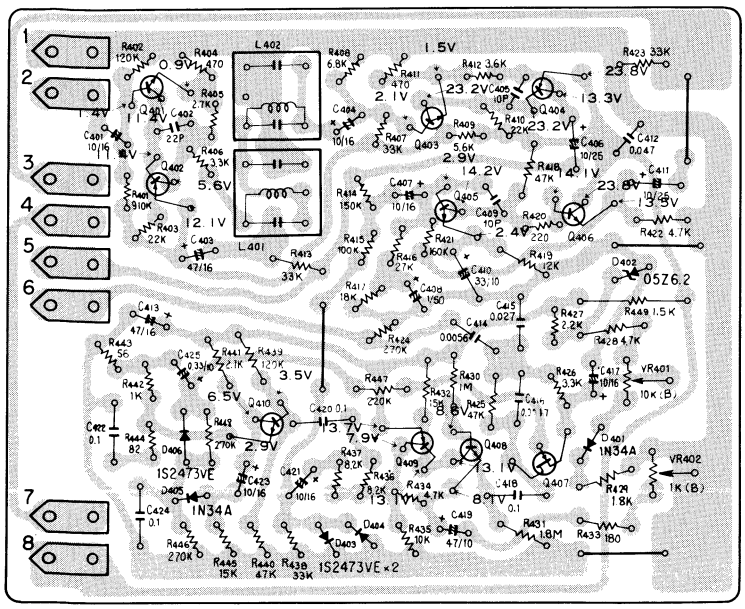
NOTE:
The indicated semiconductors are representative ones only. Other alternative semiconductors may be used and are listed in the parts list.



	Q503 BASE	Q504 BASE	Q505 BASE
STD	0.7 V	- 1.6 V	- 1.6 V
Cr O2	- 1.1 V	0.7 V	- 1.6 V
Fe Cr	- 1.1 V	- 1.6 V	0.7V

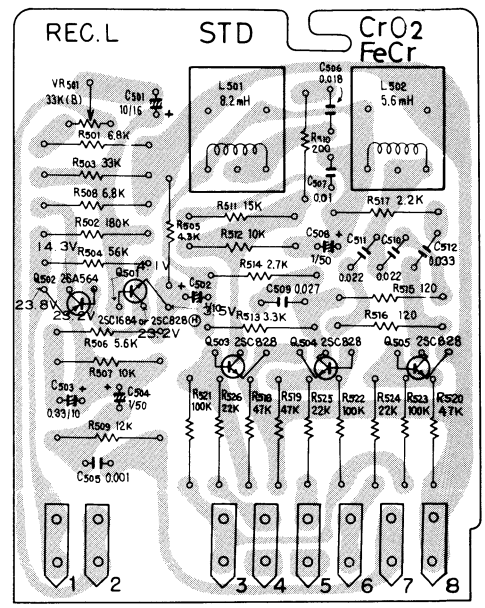
	Ⓐ	Ⓑ	Ⓒ	Ⓓ	Ⓔ	Ⓕ
STOP	0.7V	0 V	22.4V	23.1V	23V	0.7V
PLAY	0 V	23.7V	23.7V	23.2V	-3.8V	-3.8V

Dolby Processor Assembly (RWX-219)



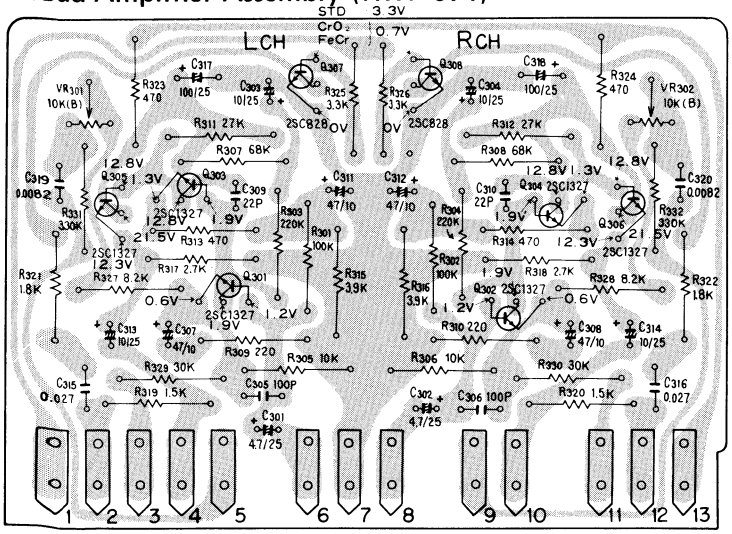
Q401, 403, 405, 408	Q402, 404, 409	Q406, 410	Q407
2SC732TM or 2SC1740LN	2SA1015 or 2SA826LN	2SC1815 or 2SC1740	2SK30AD

Rec Amplifier Assembly (RWX-072)

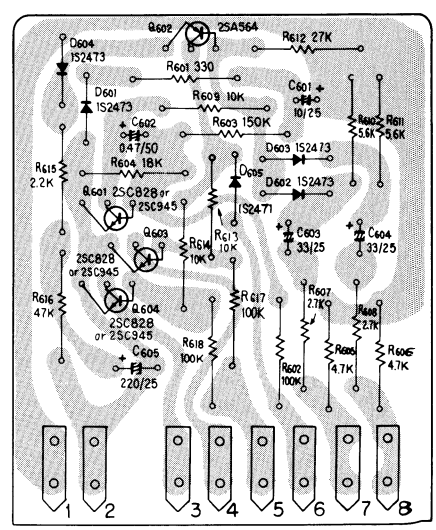


	Q503 BASE	Q504 BASE	Q505 BASE
STD	0.7V	−1.6V	−1.6V
CrO_2	−1.1V	0.7V	−1.6V
FeCr	−1.1V	−1.6V	0.7V

Head Amplifier Assembly (RWF-071)



Muting Assembly (RWX-158)



12.5 MOTHER ASSEMBLY

Parts List

ASSEMBLIES

Part No.	Symbol & Description
RWF-071	Head amplifier assembly
RWX-219	Dolby processer assembly
RWF-072	REC amplifier assembly
RWR-065	Power supply assembly
RWX-158	Muting assembly
RWX-161	Mic jack assembly

SWITCHES

Part No.	Symbol & Description
RSK-035	Lever switch (TAPE)
RSK-036	Lever switch (DOLBY)
RSH-023	Slide switch
RSH-025	Slide switch

COILS AND OTHERS

Part No.	Symbol & Description
RTV-012	T101, T102 Matching transformer
RTF-033	L101, L102 Trap coil
RTX-002	OSC block
RKN-039	Phone jack (PHONES)
RKN-038	Phone jack (MIC)
RKB-013	Pin jack
RBF-042	Ceramic tube

CAPACITORS

Part No.	Symbol & Description
RCE-022	C101, C102
CEA100P 16	C103, C104, C107, C108
CEA2R2P 50	C105, C106
RCE-003	C109, C110
RCE-009	C111, C112
CEA100P 25	C113, C114, C203
CEA4R7P 35	C201
CKDYF 103Z 50	C202
CKDYF473Z 50	C204, C205
CEA470P 10	C206
CEA0R47P 50	C207

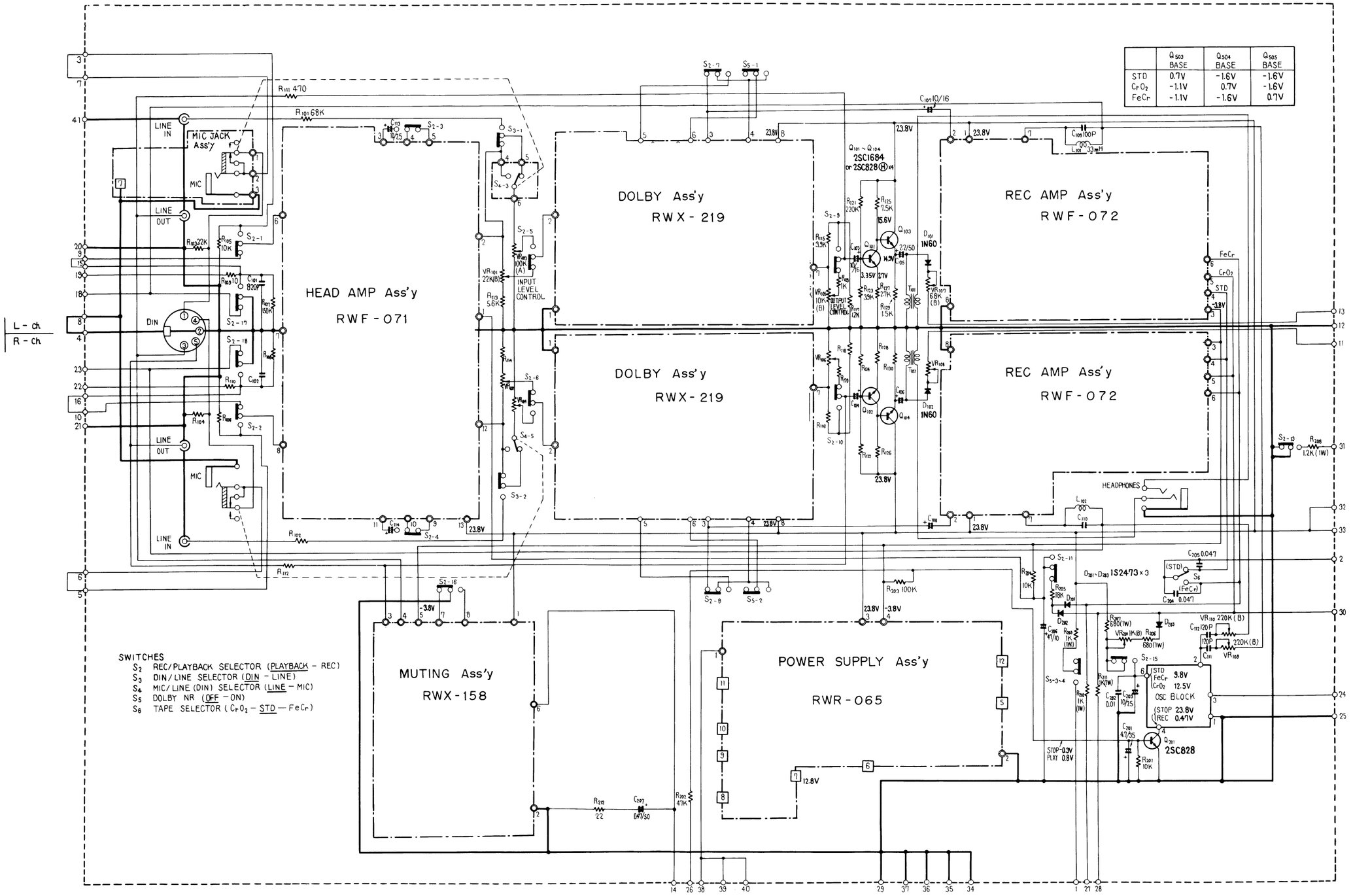
Note: When ordering resistors, convert the resistance value into code form, and then rewrite the part no. as before.

RESISTORS

Part No.	Symbol & Description
C92-857	VR101, VR102 Variable (Semi-fixed) 22kB
RCV-036	VR103, VR104 Variable resistor
RCV-037	VR105, VR106 Variable resistor
RCP-001	VR107, VR108 Variable (Semi-fixed) 6.8kB
RCP-005	VR109, VR110 Variable (Semi-fixed) 220kB
C92-404	VR201 Variable (Semi-fixed) 1kB
RD¼PS □□□ J	R101–R130, R201–R205
RS1P □□□ J	R206–R211
RD¼PSF □□□ J	R212

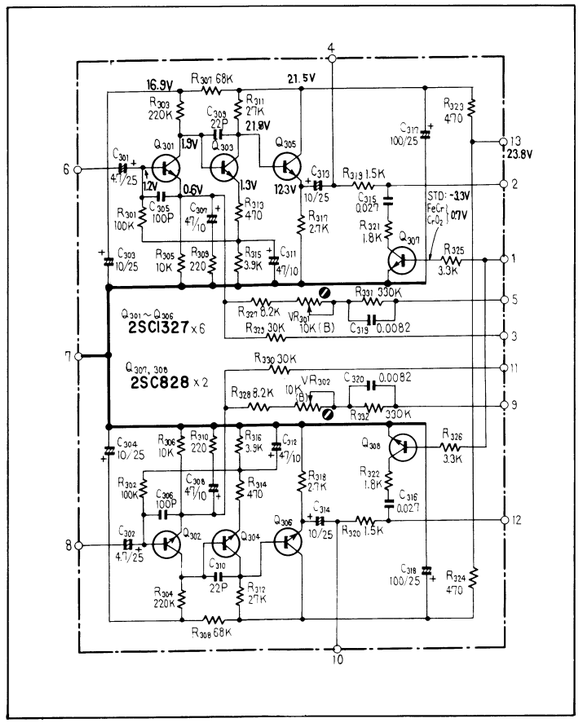
SEMICONDUCTORS

Part No.	Symbol & Description
2SC1684-R (2SC1684-S) (2SC828H-R) (2SC828H-S)	Q101–R104
2SC828-R (2SC828-S) (2SC828-Q)	Q201
1N60	D101, D102
1S2473	D201–D203



	Q503 BASE	Q504 BASE	Q505 BASE
STD	0.7V	-1.6V	-1.6V
CrO_2	-1.1V	0.7V	-1.6V
FeCr	-1.1V	-1.6V	0.7V

12.6 HEAD AMPLIFIER ASSEMBLY (RWF-071)



Parts List

CAPACITORS

Part No.	Symbol & Description
RCH-017	C301, C302
CEA100P 25	C303, C304, C313, C314
CCDSL101K 50	C305, C306
CEA470P 10	C307, C308, C311, C312
CCDSL220K 50	C309, C310
CQMA273K 50	C315, C316
CEA101P 25	C317, C318
CQMA822K 50	C319, C320

Note: When ordering resistors, convert the resistance value into code form, and then rewrite the part no. as before.

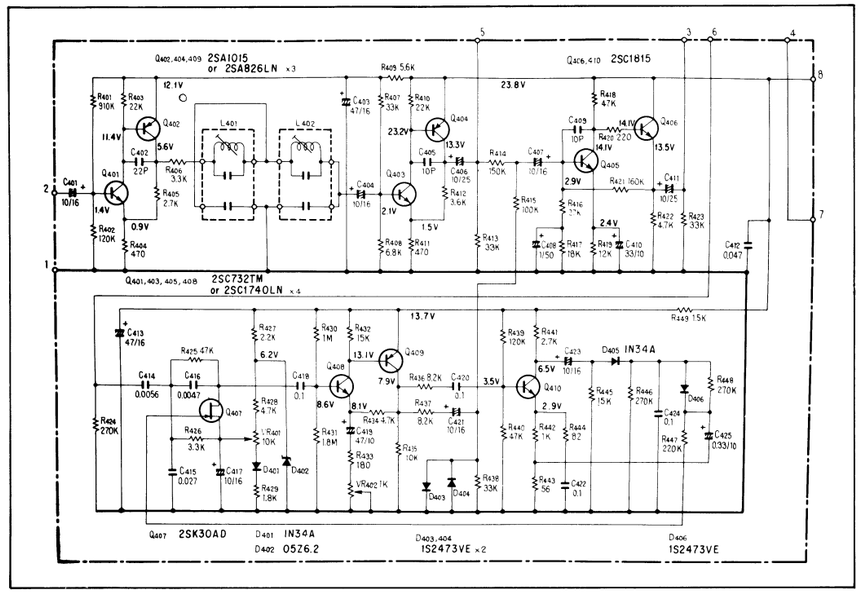
RESISTORS

Part No.	Symbol & Description
RCP-032	VR301, VR302 Variable (Semi-fixed) 10k
RD¼PS □□□J	R301 – R332

SEMICONDUCTORS

Part No.	Symbol & Description
2SC1327-T (2SC1327-U)	Q301 – Q306
2SC828-R (2SC828-S) (2SC828-Q)	Q307, Q308

12.7 DOLBY PROCESSOR ASSEMBLY (RWX-219)



Parts List

COILS

Part No.	Symbol & Description
RTF-034	L401 MPX coil C
RTF-035	L402 MPX coil D

CAPACITORS

Part No.	Symbol & Description
CEA 100P 16	C401, C404, C407, C417, C421, C423
CCDSL 220K 50	C402
CEA 470P 16	C403, C413
CCDSL 100K 50	C405, C409
CEA 100P 25	C406, C411
CEA 010P 50	C408
CEA 330P 10	C410
CKDYF 473Z 50	C412
CQMA 562J 50	C414
CQMA 273J 50	C415
CQMA 472J 50	C416
CQMA 104K 50	C418, C420, C422, C424
CEA 470P 10	C419
CSSA 0R33M 10	C425

Note: When ordering resistors, convert the resistance value into code form, and then rewrite the part no. as before.

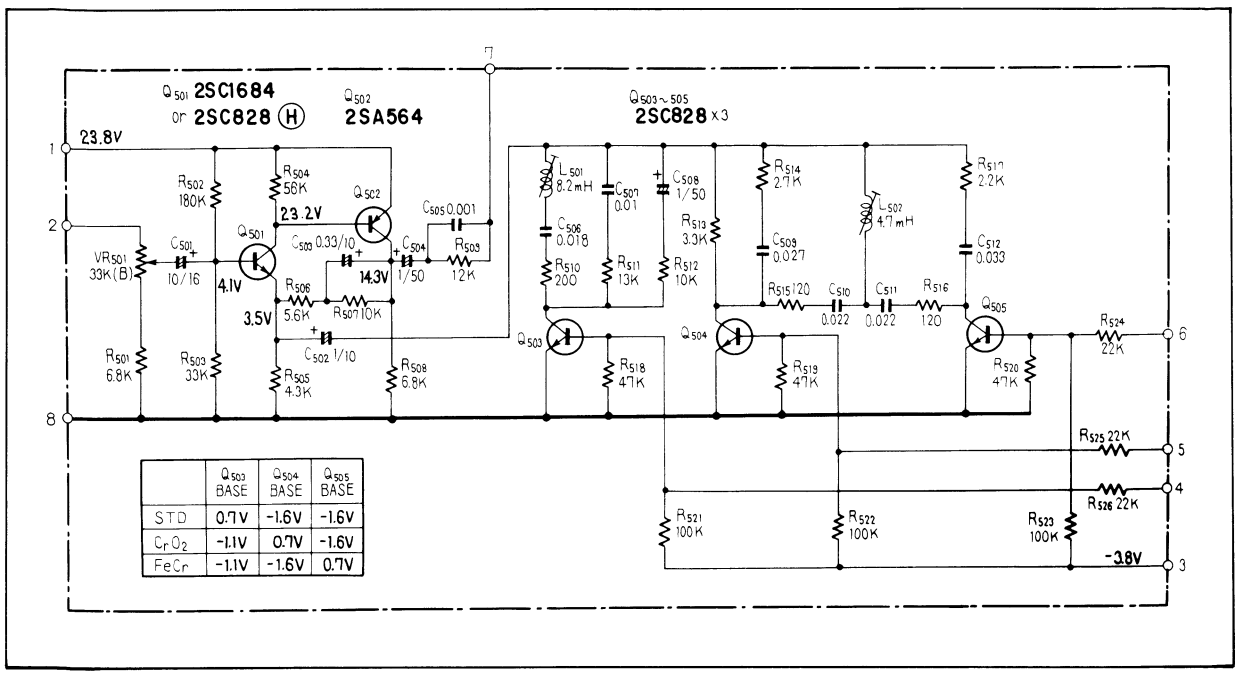
RESISTORS

Part No.	Symbol & Description
RCP-034	VR401 Semi fixed 10k
RCP-033	VR402 Semi fixed 1k
RD¼PS □□□J	R401 ~ R448
RD¼PSF □□□J	R449

SEMICONDUCTORS

Part No.	Symbol & Description
2SC732TM-GR or BL (2SC1740LN-R or S)	Q401, Q403, Q405, Q408
2SA1015-Y or GR (2SA826LN-O or R)	Q402, Q404, Q409
2SC1815-Y or GR (2SC1740LN-O or R)	Q406, Q410
2SK30AD	Q407
1N34A	D401, D405
05Z6.2	D402
1S2473VE	D403, D404, D406

12.8 REC AMPLIFIER ASSEMBLY (RWF-072)



Parts List

COILS

Part No.	Symbol & Description		
RTF-032	L501	Peaking coil	8.2mH
RTF-031	L502	Peaking coil	4.7mH

CAPACITORS

Part No.	Symbol & Description
CEA100P 16	C501
CEA010P 50	C502, C504, C508
CSSA0R33M 10	C503
CQMA102K 50	C505
CQMA183K 50	C506
CQMA103K 50	C507
CQMA273K 50	C509
CQMA223K 50	C510, C511
CQMA333K 50	C512

Note: When ordering resistors, convert the resistance value into code form, and then rewrite the part no. as before.

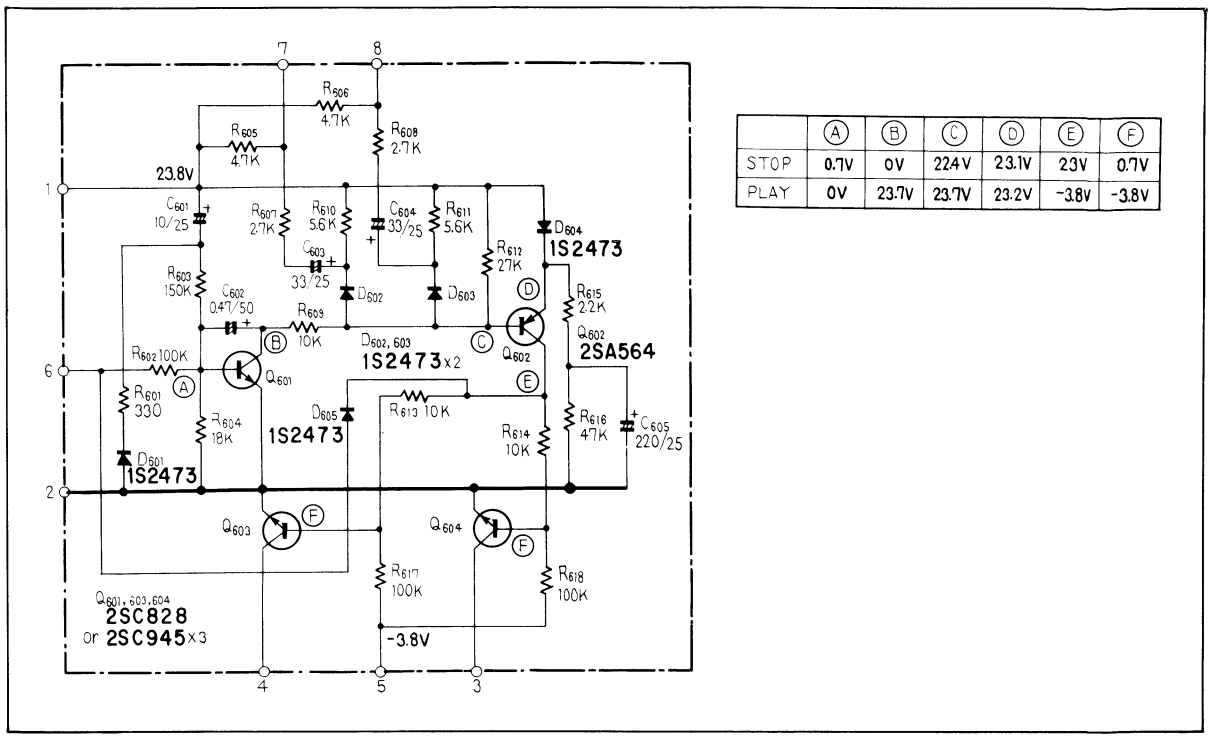
RESISTORS

Part No.	Symbol & Description
RCP-037	VR501 Variable (Semi-fixed) 33kB
RD¼PS □□□ J	R501 – R526

SEMICONDUCTORS

Part No.	Symbol & Description
2SC1684-R (2SC1684-S) (2SC828H-R) (2SC828H-S)	Q501
2SA564-R (2SA564-S)	Q502
2SC828-R (2SC828-S) (2SC828-Q)	Q503 – Q505

12.9 MUTING ASSEMBLY (RWX-158)



	Ⓐ	Ⓑ	Ⓒ	Ⓓ	Ⓔ	Ⓕ
STOP	0.7V	0V	22.4V	23.1V	23V	0.7V
PLAY	0V	23.7V	23.7V	23.2V	-3.8V	-3.8V

Parts List

CAPACITORS

Part No.	Symbol & Description
CEA100P 25	C601
CEA0R47P 50	C602
CEA330P 25	C603, C604
CEA221P 25	C605

Note: When ordering resistors, convert the resistance value into code form, and then rewrite the part no. as before.

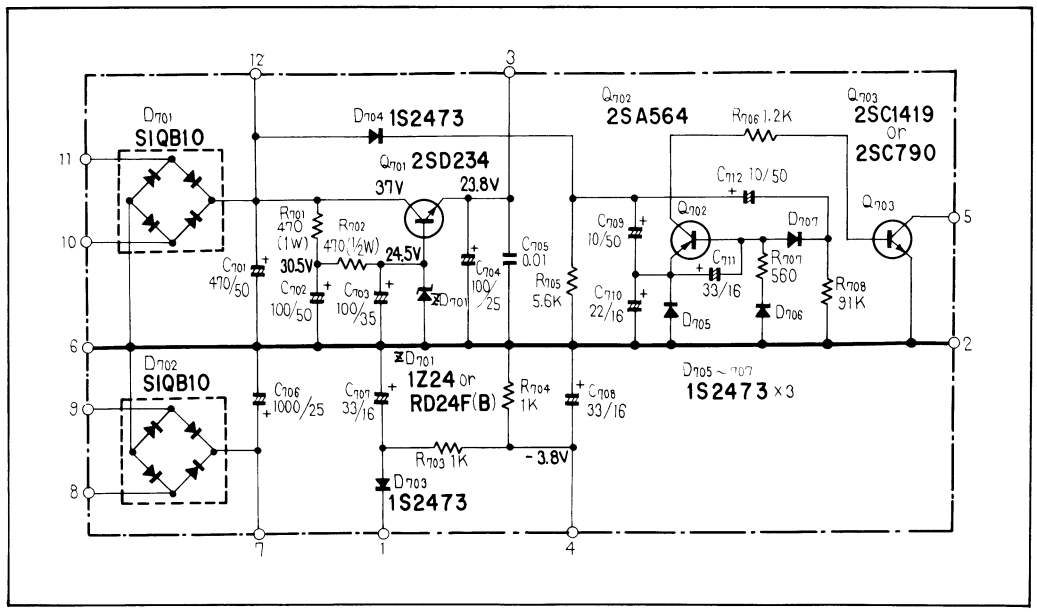
RESISTORS

Part No.	Symbol & Description
RD¼PS □□□ J	R601 – R618

SEMICONDUCTORS

Part No.	Symbol & Description
2SC828-R	Q601, Q603, Q604
(2SC828-S)	
(2SC828-Q)	
2SA564-R	Q602
(2SA564-S)	
(2SA564-Q)	
1S2473	D601 – D604
1S2471	D605

12.10 POWER SUPPLY ASSEMBLY (RWR-065)



Parts List

CAPACITORS

Part No.	Symbol & Description
CEA471P 50	C701
CEA101P 50	C702
CEA101P 35	C703
CEA101P 25	C704
CKDYF103Z 50	C705
CEA102P 25	C706
CEA330P 16	C707, C708, C711
CEA100P 50	C709, C712
CEA220P 16	C710

Note: When ordering resistors, convert the resistance value into code form, and then rewrite the part no. as before.

RESISTORS

Part No.	Symbol & Description
RS1P □□□ J	R701
RD½PSF □ □□ J	R702
RD¼PS □□ □ J	R703–R708

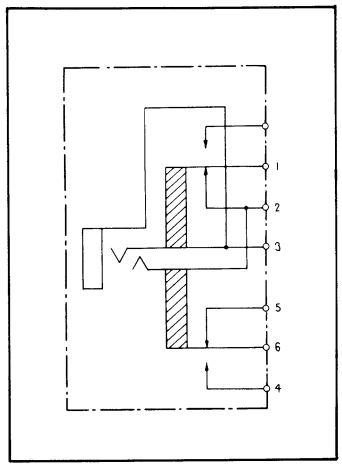
SEMICONDUCTORS

Part No.	Symbol & Description
2SD234-O (2SD234-R)	Q701
2SA564-R (2SA564-S)	Q702
2SC1419-C	Q703
SIQB10	D701, D702
1S2473	D703–D707
RD24FB (1Z24)	ZD701

OTHER

Part No.	Symbol & Description
RBF-041	Ceramic tube

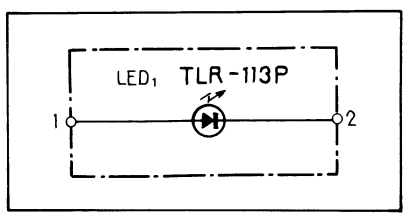
12.11 MIC JACK ASSEMBLY (RWX-161)



Parts List

Part No.	Symbol & Description
RKN-038	MIC jack

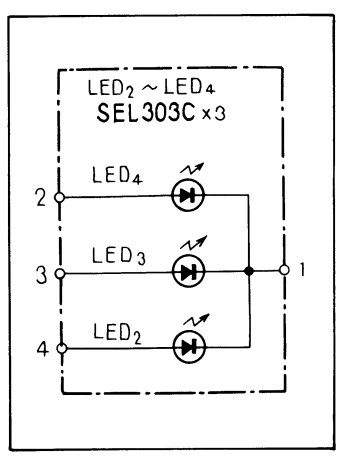
12.12 REC INDICATOR ASSEMBLY (RWX-160)



Parts List

Part No.	Symbol & Description
TLR-113P	LED1
REB-214	Diode spacer

12.13 INDICATOR ASSEMBLY (RWX-159)



Parts List

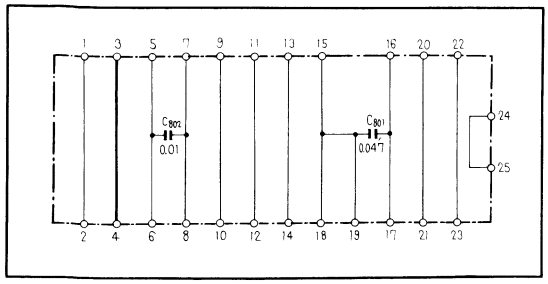
SEMICONDUCTORS

Part No.	Symbol & Description
SEL 303C	LED2–LED4

OTHER

Part No.	Symbol & Description
REB-213	Diode holder

12.14 CONNECTION ASSEMBLY (RWX-162)

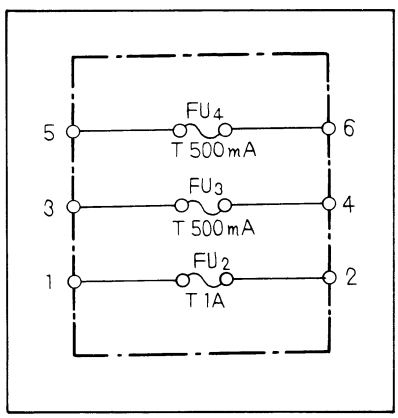


Parts List

CAPACITORS

Part No.	Symbol & Description
CQMA473K 50	C801
CQMA103K 50	C802

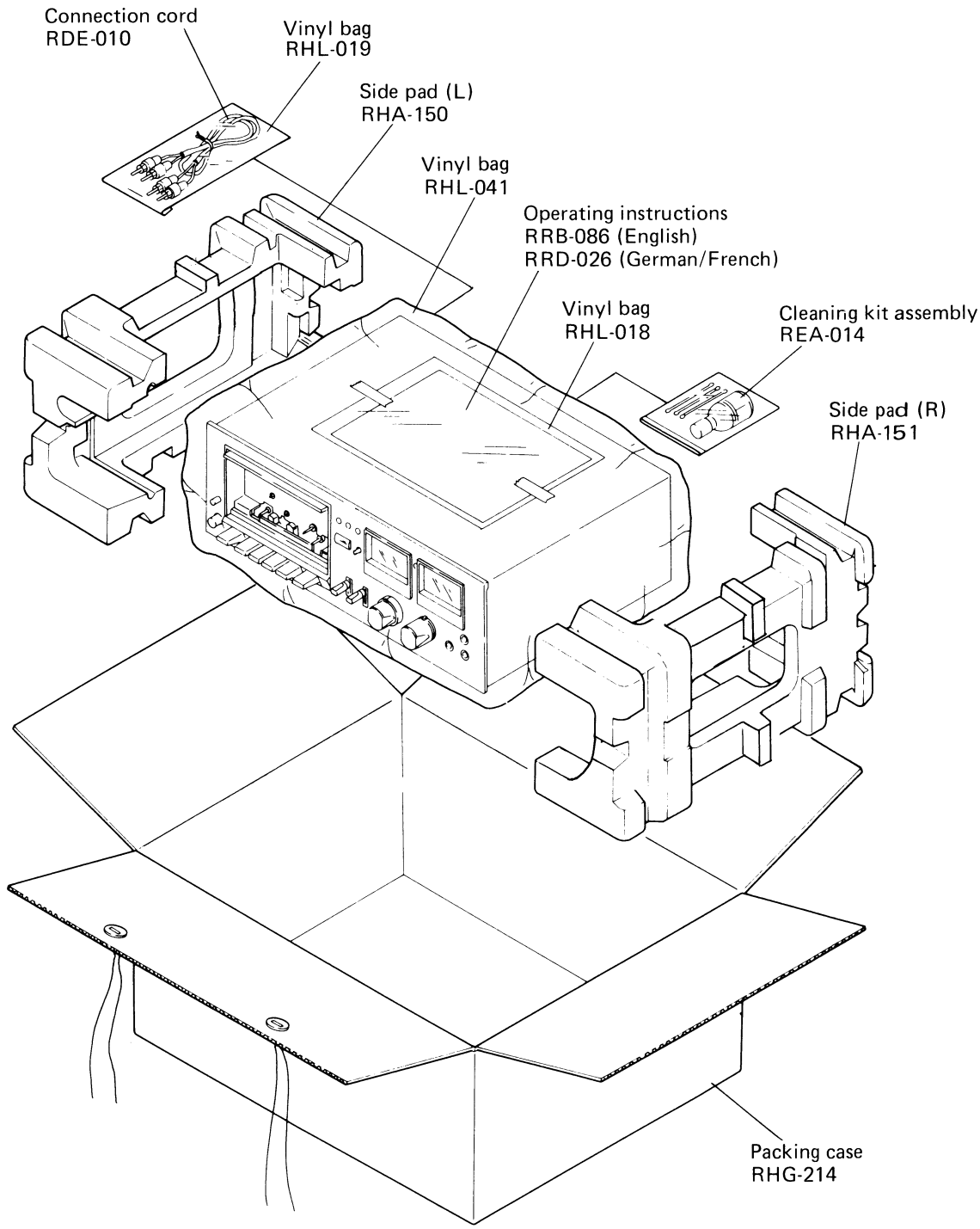
12.15 FUSE ASSEMBLY (RWX-206)



Parts List

Part No.	Symbol & Description	
REK-056	FU2	Fuse 1A
REK-049	FU3, FU4	Fuse 500mA

13. PACKING


Connection cord
RDE-010
Vinyl bag
RHL-019
Side pad (L)
RHA-150
Vinyl bag
RHL-041
Operating instructions
RRB-086 (English)
RRD-026 (German/French)
Vinyl bag
RHL-018
Cleaning kit assembly
REA-014
Side pad (R)
RHA-151
Packing case
RHG-214